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In one feature the committee reports of this convention deserve special praise. They have reached definite conclusions, and have made recommendations. In this they accomplished what they started out to do, and though their conclusions may not always be accepted, they have formed a nucleus for discussion, and have showed that the committees have not been meandering through a mass of data without getting enough out of it to produce results.

The beneficent results of railway legislation are often different from those intended or remotely anticipated. In the discussion on Ballast, a member called attention to the fact that the old-time ash pans with closed bottoms were fairly tight and retained the ashes in the pan. The new self-dumping ash pans required by federal law open directly on to the track, and when slightly warped will leak constantly and are often open when the engine is running. This indicates that the general introduction of self-dumping ash pans is resulting in the wholesale filling up of the ballast with ashes, thus seriously affecting its draining quality—a damage to track for which the motive power department will be held responsible.

A point was brought up yesterday morning in connection with the discussion of the Buildings report questioning the advisability of going too far into details. For example, in standardizing or recommending peculiar constructions for the erection of section houses, the details of these will always be varied to suit local conditions and to meet the views of the engineers in charge, so that it is useless to specify or even recommend how the walls should be covered, or the kind of windows to be used. An engineer who is competent to occupy the position in charge of the maintenance of way on a railway, would certainly be competent to design a section house, and would do it to suit himself regardless of what the association might recommend. A paper or report on the subject would be of value only as giving information as to what had been done; beyond this its usefulness ceases. On the other hand, too many detailed recommendations may be actually injurious, as giving unscrupulous lawyers a basis for an argument in case of suits, where there may be a variation from strict compliance with the recommendations, even though the practice followed may be as good or better than that which has met with the approval of the association.

The statement made on Wednesday that a half-inch widening of the gage was a matter of no moment, provided only there was enough of it, struck some outsiders as being radical. One speaker did call attention to its effect on the nosing of engines, and thought that gage widening would make it worse. There is another point that was not mentioned, namely, that if the gage is widened to such an extent it is essential that the surfacing should be in prime condition. A low joint or a high spot tends to throw the locomotive or car to one side or the other, and so start a nosing action that is apt to increase, according to the speed, and may result in some decidedly heavy blows being dealt to the rails. The committee hedged when it came to curves; the understanding of the recommendations is that the track be kept to the proper gage on curves. This is, of course, essential in order to avoid heavy blows to the guard rails. If there were to be such a condition it is possible that the power required to slip the wheels laterally on the rails would rise to as much as 65,000 lbs. or more. The practice in holding the track to gage on curves, too, is taking a step contrary to what was nearly universal a few years ago. Many engineers are laying their rails to standard gage around curves, even of short radius. There is no doubt that a car or locomotive can be piloted to go and will go around a curve so laid. But some work that was done on rail a short time ago seems to indicate that there is a binding of the wheels on this tight gage that does not occur, where it is a little loose, and that a good deal of extra stress is being put upon the spikes, that might be relieved by following the old practice.

It seems almost certain that the coal miners in the middle West will strike April 1st, and the regular supply of coal for locomotives and industrial purposes will be shut off. In anticipation of this the railroads have been storing coal, and some of them have a supply sufficient for two or three months. For the past month the price of coal in Illinois, Iowa and Indiana has been considerably advanced, and to check this a large amount of bituminous coal has been bought in Ohio and Pennsylvania for storage. The price there has not advanced, the quality of the coal is much better, coming from older measures, and being harder than the western coals, it is better suited for storage purposes. Its higher heat value will largely make up for the cost of the extra haul, and if it is required to be held in storage for some time, it will not deteriorate to any large extent, and when used will be at least equal to the fresh coal from local western mines. As an indication of the amount of coal used by railroads and the enormous quantity required to be stored for a few months' supply, we may cite the report of the fuel agent of the Rock Island, showing the consumption of coal for January, 1910, on the Rock Island and affiliated lines: For passenger engines the fuel consumed was 90,000 tons, averaging 22.63 lbs. per passenger car mile; in freight service the consumption was 168,000 tons, averaging 318.4 lbs. per 1000 ton miles. The

total consumption per month was 258,000 tons, or 8,600 tons per day. The daily requirements for coal on the Burlington system is 14,000 tons in winter and 10,000 to 12,000 tons in summer, or say an average of 360,000 tons per month, which would mean 9,000 cars containing 40 tons each. To provide for a strike lasting two months there would be required for this one system a storage of about 700,000 tons of coal. In the East anthracite coal is stored in vast quantities and machinery is installed for piling the coal in larger cones and for loading it in cars when wanted. While most western bituminous coals are not well adapted to such storage in large bulk, it is possible that if the miners' strike is of long duration better provisions for storage will be demanded for the future, and structures for its protection and perhaps machinery for reloading it will be devised.

ORGANIZING THE CONVENTION.

It is doubtful if, ten years ago, the founders of the American Railway Engineering and Maintenance of Way Association realized to how great an extent it would grow or to what a place it would attain among the various engineering and railway associations. Naturally enough, the subjects first considered have been those most vital to the association, and with the adoption of the reports of this year's committees, standards will have been adopted for the most of these. It is not unnatural that there should be a sense of work accomplished, of labor well done, and a feeling that the work which is to follow will be of less importance and of consequent less interest.

Now that the membership has grown to such an extent and the attendance at the conventions to a greater extent, the machinery for still better and more beneficial work is at hand. Everyone who has had occasion to reflect on the subject of railway organization has realized the complexity of that on a single road, due to the various ideas and personalities of its members. The most successful executive is the man who forces or leads all these to a common purpose, and who, while leaving each man free to give of his best, eliminates as far as possible the defects inherent in human nature. The likeness of a successful organization of men to a machine is trite, but true, and if it be so on one railway, how much more vast is the machine comprising all the roads in the country, and how much greater the difficulty in amalgamating the ideas and energies of all the individuals on them. This, however, so far as its department of engineering and maintenance of way is concerned, is the task of the association. The elimination of the personal equation through the annual contact of individuals, the comparison of ideas and practice, the standardization, not necessarily for all time, but for the moment, of all that is best in each, may be the highest function of the association. That the work which has already been done in establishing standards has found ready recognition is evidenced by their wide adoption, but it must not be considered that all the hard or valuable work has been done or that what is now left to be settled is of minor importance or of mere detail. It is evident that this feeling exists, in some degree, at least, but it is to be hoped that it will not become general, because it is not warranted, and because it does exist there is all the more reason to urge its dismissal.

Now that the membership is so great, so interested, and so enthusiastic, it would be a pity to allow any feeling that the big things have been settled to interfere with the further development of the association.

Not the least interesting is the development of the social side of the association. While this feature may, at first thought, seem of minor importance, it is by no means a negligible quantity in estimating the assets of the convention, if its various attractions may be so termed. The prospect of interchange of good fellowship is not less pleasant, if perhaps less profitable, than the interchange of technicalities of no matter how great interest.

To those most interested in the welfare of the association the outlook should hold nothing but encouragement.

WATER SERVICE.

The usual method of treating boiler waters containing sulphates of lime and magnesia is by the use of soda ash, which, though fairly efficient and satisfactory, is open to two objections. The first is the expense of the soda ash and the second is, that while the chemical reaction removes the hard scale-making sulphates of lime and magnesia, it leaves soluble sulphate of soda, which increases the tendency to foam. This latter has been one of the principal difficulties connected with water treatment for locomotives by soda salts, as the foaming tendency is very objectionable. A new method of treating such waters is now being used in England for both locomotive and stationary boilers, and although the process is successful in preventing hard scale from waters containing 20 to 30 grains incrusting matter to the gallon, no chemicals are used, and it is, therefore, inexpensive as compared with soda ash treatment. The apparatus, which is called a "luminator," consists of a thin sheet of aluminum which is corrugated, 1-5 in. wide and about 1 in. deep, the dimensions varying with the amount of water to be treated. A strip of the corrugated metal 3 or 4 ft. long is set in an almost vertical position and the water flows down over it, being fed from a header through small tubes, each of which leads into one of the corrugations. There is no chemical change produced on the water by the apparatus and the hardness remains the same. The effect seems to be due to the action of light, which in some way changes calcium sulphate so that it does not crystallize, but is precipitated as a finely divided amorphus powder and magnesium sulphate also is completely ionized and is precipitated as a fine powder. These precipitates are easily washed or blown out instead of depositing a very hard scale on the tubes and firebox. A strange thing connected with the process is that it is found necessary to give the apparatus 12 hours' continuous rest during daylight every seventh day, and it then can be used day and night. This mysterious action of the apparatus and the uncertainty of the explanation may cause one to think it is a fake and our report a fairy story, but the apparatus has been in successful use over six months in a number of establishments about London, and it is being investigated by one of the German Imperial laboratories, and our report is from a most reliable contemporary, London Engineering.

THE STEEL INDUSTRY.

Conditions in the steel industry have undergone a great change since 1907, when the question of discard from the ingot in rail manufacture first became very important. In 1906, and in 1907 up to October, the panic month, the capacity of the Bessemer steel works was strained to get out maximum output. The position of the mills was that to increase the discard was to reduce the output of the works, as they wished to charge for increased discard largely on the basis of the loss of profits through reduced output, rather than on the basis of the mere increase in shop cost involved.

Whatever may be the attitude of mill owners at present, the physical position of the mills has entirely changed since then. During the past four or six months the open-health steel capacity of the country has been practically fully engaged, while the Bessemer capacity has been but

indifferently engaged. The Edgar Thomson plant, the chief rail plant of the Carnegie Steel Company, has not averaged more than one-third capacity in the past twelvemonth, while the Cambria, Pennsylvania and Maryland rail mills have been but indifferently engaged. The Cambria Steel Company is erecting a plant to engage in the manufacture of wire, to find an additional outlet for its Bessemer steel, while the Maryland mill has been rolling billets part of the time. The Bessemer department at the Homestead steel works of the Carnegie Steel Company constituted practically the last important steel-making capacity to be put in operation in the revival last year, and there had been doubts, after its being closed late in 1907, whether it would ever operate again.

Thus there is clearly an excess of Bessemer steel-making capacity in the country, as compared with the demand for the different finished products. Bessemer steel is practically tobooed for plates for any purpose, and finds but limited acceptance in structural shapes, with the prospect that it will be shut out entirely.

The question arises what shall be done with the existing equipment for the manufacture of Bessemer steel rails? It would be costly to remodel plants so as to roll the Bessemer steel into other finished products, while it is questionable whether demand could be found for the additional products in Bessemer steel.

The basic open-hearth steel industry, which has continued to make rapid strides in tonnage output, has found it increasingly difficult to obtain the scrap necessary for carrying on the process along the usual line. The Monell and Talbot processes, essentially non-scrap processes, have not justified all the hopes entertained for them, and there is a strong tendency to turn to duplexing. The Jones & Laughlin Steel Company has been experimenting for some months with the duplex process in its present Pittsburg plant, with the idea of using a portion of its Bessemer capacity for preparing metal for its open-hearth furnaces, thus decreasing its output of Bessemer steel and correspondingly increasing the open-hearth output. The Maryland Steel Company is completing five open-hearth furnaces with the intention of using a portion of its present Bessemer capacity to duplex with the new open-hearth furnaces.

These moves in the direction of duplexing represent a distinct desire to find a new use for Bessemer capacity because there is not sufficient employment for it in its old function.

The major portion of the scrap used in the ordinary open-hearth steel process has been new scrap, produced in the casting and rolling of both Bessemer and open-hearth steel, old material constituting only a minor portion of the total scrap used. The production of basic open-hearth steel first passed the million-ton mark in 1897, and while production increased rapidly thereafter, the production of Bessemer steel also increased, increasing the supply of scrap, although not in proportion to the increase in the requirements. The production of Bessemer steel reached its maximum in 1906, with 12,275,830 tons, production of basic open-hearth steel in the same year being 9,658,760 tons. Since 1906 the production of Bessemer steel has been decreasing, while production of basic open-hearth steel has continued to increase. Estimates based on Bessemer pig iron production in 1909 place the output of Bessemer steel in that year at between 9,300,000 and 9,400,000 tons, while it is conjectured that the output of basic open-hearth steel lay between 13,000,000 and 15,000,000 tons.

There is thus vastly more pressure for new steel scrap for the basic open-hearth furnace than there was in 1906 or even 1907. Prices in the market illustrate this. Statistics compiled by authorities indicate that in 1906 and 1907, for delivery to Pittsburg and valley steel works, heavy melting steel scraps averaged from $2 to $4 a ton less than basic pig iron f. o. b. valley furnaces, while the average in 1909 was nearly a dollar a ton in the opposite direction, showing a total change in the alignment of $4 a ton; scrap, relative to pig iron, advancing by approximately that amount.

Thus, on account of the increase in basic open-hearth steel manufacture and the decrease in Bessemer steel manufacture there is a great deal more pressure to obtain scrap than there was three or four years ago. It is reasonable to infer that Bessemer steel rail manufacturers having open-hearth adjuncts should be much more ready than formerly to run their Bessemer departments with a view to furnishing scrap for the open-hearth, and to be willing to crop more liberally in manufacturing rails. It is no longer a question of reduced outputs for Bessemer rail mills if more liberal cropping is resorted to, for there is not enough work to keep the Bessemer rail mills busy. More liberal cropping would rather increase outputs by finding more orders and permitting the mills to run nearer to capacity.

The case of the Bessemer steel rail is by no means hopeless for the 1909 statistics, just out, show that of the 50,505 tons of alloyed steel rails made, 36,809 tons were Bessemer, and only 13,696 tons open-hearth.

COMPETITIVE RAILWAY BUILDING IN THE DES CHUTES RIVER CANYON.

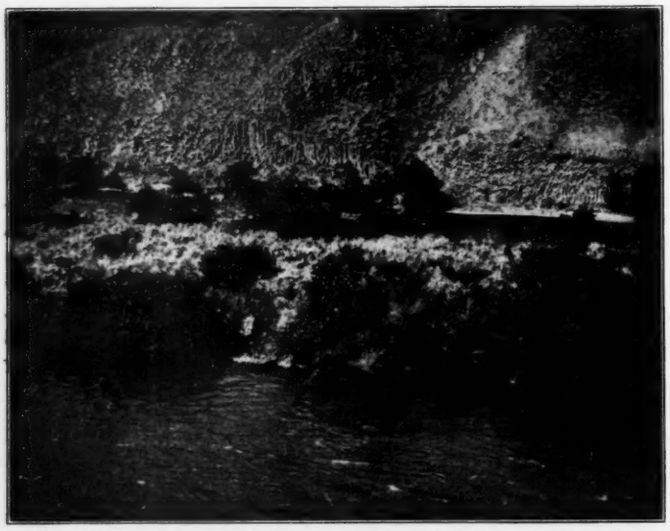
The Des Chutes Railroad (Harriman Lines) and the Oregon Trunk Railway (Hill Lines) are building parallel lines up the Des Chutes river canyon into central Oregon. The history of these projects and their traffic possibilities were fully discussed in the Railroad Age Gazette of November 12, 1909, p. 905. The plateau between the Cascade range and the Blue mountains has been without railway or waterway

Looking North from Mile 32; Des Chutes Railroad.

transportation, except for the branch of the Oregon Railroad & Navigation Company which runs down to Shaniko, 70 miles from the Columbia river, and some shorter branches to the east of this one. The Des Chutes river is not navigable. Wheat growing has been extended so far as is possible without adequate transportation facilities, the crops being hauled by wagon for long distances. In 1907 an attempt was made to haul for 50 miles, with a traction engine and a train of road cars, 1,000,000 bushels of wheat raised near Madras. This proved to be a failure. The country is, therefore, undeveloped, no town which the new railway lines will reach having more than 1,500 population, and the land has been largely used for stock raising. With outlets to market it will become a big wheat country, taking the

place of the land in the coast counties of Oregon, formerly devoted to wheat, but now given over to the more profitable dairying, fruit growing and truck farming. Later, as land gets more valuable in central Oregon, this higher grade farming will follow the wheat on the land best suited to it, namely, the slopes and the irrigated country. Several irrigation projects are now under way. The timber on the eastern slopes of the Cascades is the best in the state, being part of the forest already tapped in the Klamath country. The Des Chutes is an excellent power stream, and considerable hydro-electric development is expected.

The Des Chutes Railroad will run from Des Chutes, on the Oregon Railroad & Navigation, south to Redmond, 130 miles. For the first 83 miles it follows the east bank of the Des Chutes river, keeping at the bottom of the canyon close to the high water level of the river. The maximum grade on this part of the line is 0.8 per cent., and the maximum curvature is 17 deg., 30 min. Fifty-two miles of the first 80 is curved track, the greater part being less than 4 deg.; of the total 9,859 deg. of curvature, 822 deg. are over 10 deg. The line leaves the Des Chutes river at Mile 83 and turns up the Trout creek valley for a few miles, and thence,



Island in Des Chutes River.

In making its third crossing of the Des Chutes River, the Oregon Trunk goes over this island, coming across from the far side (west bank) shown in the photograph.

with considerable development work, continues south. There is a nearly continuous 1.5 per cent. grade as far as Madras, 15 miles, and the maximum grade is 1 per cent. from there to Redmond. The maximum grade opposing northbound traffic is 1 per cent. as now located, and, as shown on the profile, this is to be reduced to 0.6 per cent. Between Mile 80 and Mile 100 there are 11 miles of curved track, most of which is between 4 and 10 deg., there being only 89 deg. of curvature over 10 deg. In the 30 miles from Madras to Redmond there are 6 miles of curved track, all of which is less than 4 deg. except 46 deg. of curvature between 4 and 10 deg.

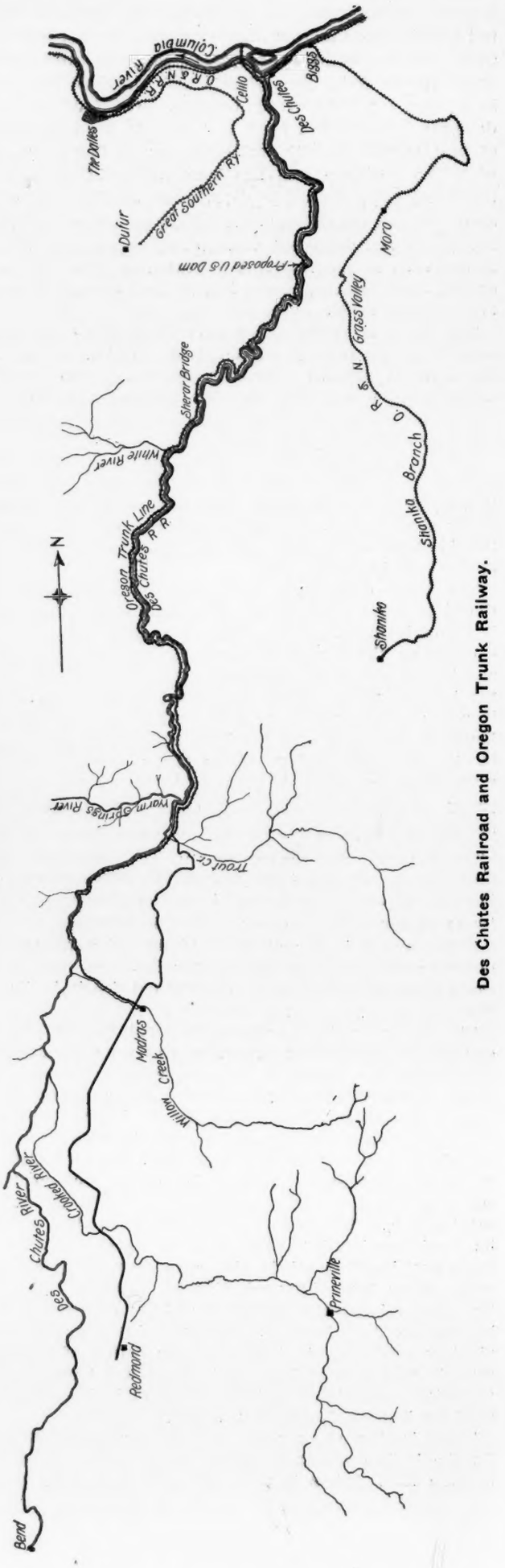
Most of the cut work is through hard, volcanic rock, the character of which is shown in the photographs. The yardage of cut and borrow work is as follows:

Cut.	Cu. Yds.	Borrow.	Cu. Yds.
Solid rock	1,400,000	Solid rock	20,000
Loose rock	600,000	Loose rock	380,000
Shell rock	200,000	Common excavation*	400,000
Common excavation*	300,000		

The free haul allowed is 400 ft., and the total over-haul is estimated as 1,900,000 yds.

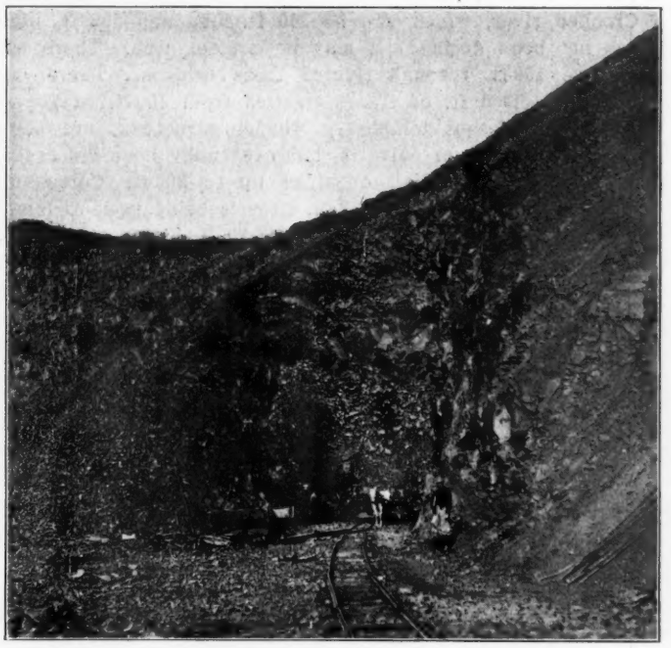
The bridge over Trout creek will be 800 ft. long, 100 ft. maximum height, and the one over Willow creek will be 1,200 ft. long and 230 ft. maximum height. Both of these

*Earth, etc., handled without blasting.



Des Chutes Railroad and Oregon Trunk Railway.

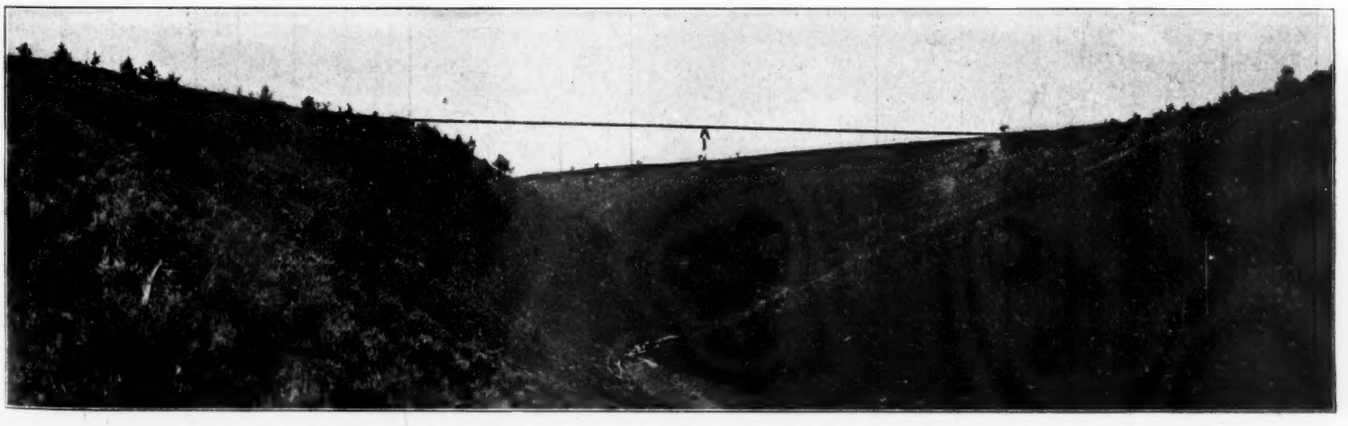
Site of Crooked River Bridge; Des Chutes Railroad.



Approach to Tunnel at Mile 33; Des Chutes Railroad.

Characteristic Rock; Des Chutes Railroad.

Characteristic Section of Lower Des Chutes Canyon.



Site of Willow Creek Bridge; Des Chutes Railroad.

will be steel viaducts. The character of the structure over Crooked river, which will be 360 ft. long and 302 ft. high, has not been decided; it may be a steel arch. There will be five 150-ft. through riveted truss bridges. There will be about 5,300 ft. of frame trestles from 10 ft. to 120 ft. high. At present temporary wooden structures are being used for the larger culverts, but eventually concrete arches will be put in for all openings up to 20 ft. Corrugated steel pipe in 2-ft. and 2-ft. 8-in. sizes is being used for small openings where the fill is less than 20 ft. high.

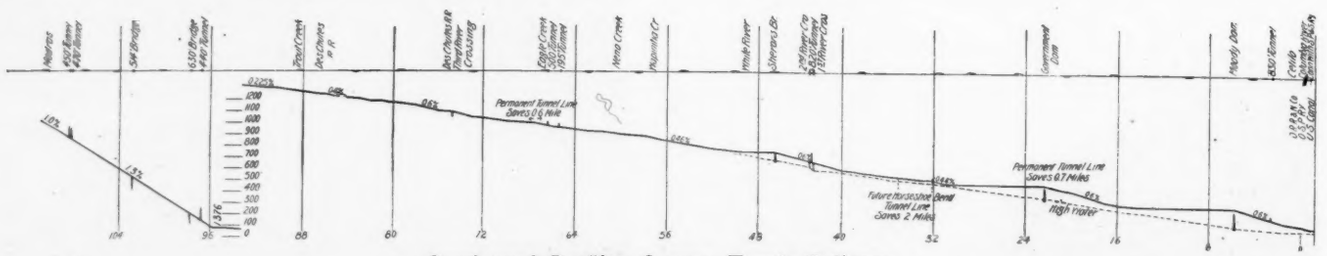
There are five tunnels ranging from 500 ft. to 1,200 ft. long. Two of them have been holed through, and work is under way on the others. Hand drills are used almost entirely, it being too expensive to get in the necessary power plant for steam or air drills. All equipment for the southern part of the line, where it is at the bottom of the canyon, had to be brought by wagon to the top of the cliffs and then lowered down on skidways. The steam shovels were knocked down and brought in in this way. This equipment and all materials are coming in via Shaniko and Grass Valley. For the northern part, now about completed, they came via Moro.

The roadway is being built 14 ft. wide on fills and 16 ft. wide in cuts, with the expectation of widening it later. The tunnels are 17 ft. wide and 24 ft. high from top of subgrade. New 75-lb. rail is being laid. Ties are 7 in. x 9 in. and tie plates are used.

John Twohy, Spokane, Wash., is the general contractor. He has at work 3,600 men and five steam shovels. The bridge work and the track-laying are being done by 350 men of the railway company's forces. Construction began last September. There are now 6 miles of track laid, and 20 miles graded from the mouth of the river south and 25 miles more graded in isolated stretches. It is expected that trains will be in operation by the end of July on the first 90 miles. The cost for the 130 miles is estimated at $45,000 a mile.

The Oregon Trunk Railway starts from a connection with the Spokane, Portland & Seattle on the north bank of the Columbia river. It will cross that river near Celilo, about 2 miles west of the Des Chutes, and for 75 miles it stays on the west bank of the Des Chutes, except at a point four miles north of Sherar Bridge, where it goes across and back again. At Mile 74½ it crosses to the east bank, crossing also the Des Chutes Railroad, and thence it keeps to the east of the Des Chutes Railroad as far as Trout creek, where the latter leaves the Des Chutes canyon. The Oregon Trunk keeps on up the east bank to a point near Willow creek, when it climbs out of the valley and gets into the Willow creek canyon, which it follows to Madras, 108 miles from Celilo. This is as far as the road is under contract, but it is located to Bend, 40 miles further.

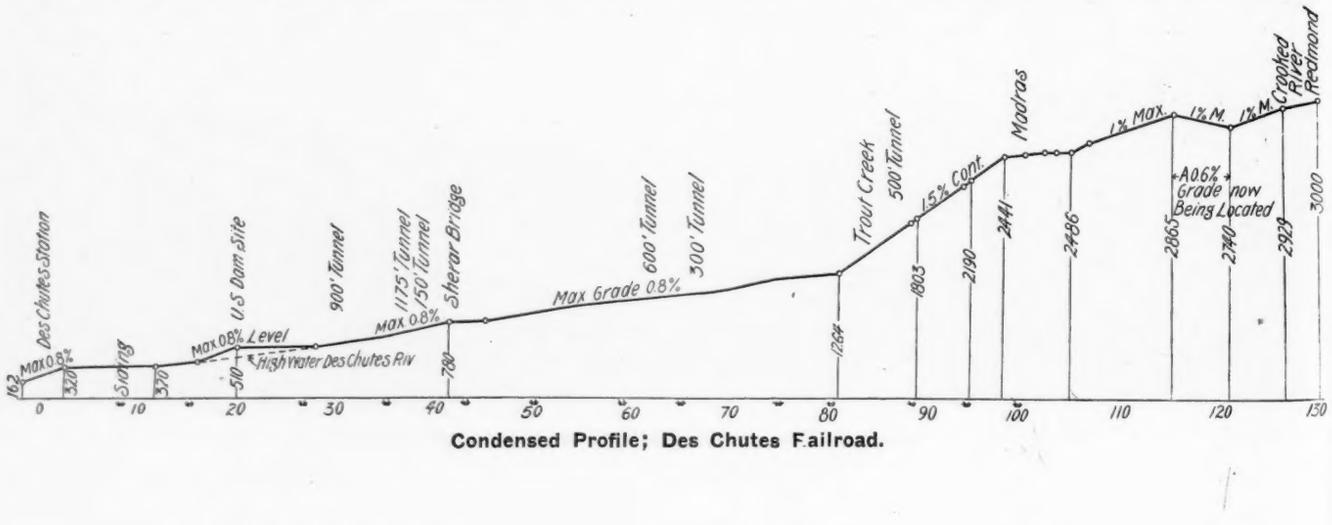
The maximum grade for the first 95 miles is 0.6 per cent., and for the remaining 14 miles the maximum is 1.3 per cent., compensated. There will be no grades opposing northbound traffic. The maximum curvature is 6 deg. There will be eight tunnels, from 200 to 850 ft. long. Ultimately, as shown on the profile, there will be three more tunnels, which will make the line several miles shorter. The bridge across the Columbia river will be 3,400 ft. long. Of the three crossings of the Des Chutes river, two will consist of two 150-ft. spans each, while the other will be a 3-span bridge. There will be about 5,000 ft. of trestles, to be eventually filled in. The larger culverts are being made of timber for the present and will later be concrete arches. Corrugated steel pipe is used in sizes from 18 in. to 60 in. in diameter. The roadway will be 18 ft. wide on earth fills, 16 ft. wide on rock fills, 24 ft. wide in earth cuts and 20 ft. wide in rock cuts. The tunnels are 16 ft. wide and 23 ft. high from the top of rail. The road is to be laid with 85-lb. and 90-lb. rail, tie plates being used on curves. The cut and fill work will be distinctly heavier than on the Des Chutes Railroad, and the total cost is correspondingly high.



Condensed Profile; Oregon Trunk Railway.

Porter Brothers, Spokane, Wash., have the general contract. They have 3,800 men at work. Work began on September 1, and there is now 25 miles graded, but no rail laid. Supplies and equipment are brought in at Des Chutes and by wagon via Dufur, on the Great Southern, and Shaniko. Only hand drills have been used so far.

Distances between sidings on each road are shown on the profiles. Little traffic is expected to originate on the first 80 miles, but the valley of the Des Chutes broadens out



Condensed Profile; Des Chutes Railroad.

somewhat near Warm Springs river, and there are already a number of productive farms in these bottoms. Both lines get up on top of the plateau at Madras.

We are indebted for the above material to G. W. Boschke, chief engineer of the Des Chutes Railroad; J. F. Stevens, president of the Oregon Trunk, and G. A. Kyle, vice-president.

THE ELEVENTH BIRTHDAY.

As a part of the celebration of the eleventh birthday of the American Railway Engineering and Maintenance of Way Association, and as a part also of the record which seems likely to be continued by The Daily Railway Age Gazette, it seems fitting to set out briefly for the benefit of the more recent recruits to the membership some of the incidents attendant upon the organization of the association and to mention some of the men who are entitled to credit for the solid foundations upon which the present sturdy structure has been erected. So far as the paper is concerned, its interest in the association is not a matter of mushroom growth. The Daily represents merely an appreciation of the development of the association itself. The call for the original meeting, at which the preliminary steps toward the organization of this now great and powerful association were taken was issued from the office of The Railway Age, one of the predecessors of the present combination, and over the signature of the editor of that paper. Beginning with the second annual convention, which, as a matter of fact, was the first meeting except for purposes of organization, the proceedings of the association have each year been published in full in the regular issue of the paper of the week of the convention. The Daily is merely an amplification of that work to correspond with the growth in importance and influence of the association itself. Its reception by engineers and those representing kindred interests upon the commercial side has been such as to warrant a forecast of a permanence like to that which has characterized another daily edition of the same journal which has for 23 consecutive years been published in honor of the annual conventions of the Master Car Builders' and the American Railway Master Mechanics' Associations. So much for The Daily.

The preliminary meeting, pursuant to the call to which reference has been made, was held in the Auditorium Hotel in Chicago on October 21, 1898, and was attended by some fifteen or twenty railway engineers and the writer of the present account. At that meeting the present name was selected. Augustus Torrey, then chief engineer of the Michigan Central, since deceased, was elected temporary chairman, Louis C. Fritch, now president, was elected temporary secretary, and a committee on permanent organization was appointed, with instructions to report at a meeting to be held in Buffalo on March 30, 1899. This committee, to whose members much of the substantial character of the organization is due, consisted of J. F. Wallace, then chief engineer Illinois Central; W. G. Curtis, since deceased, then engineer maintenance of way Southern Pacific; Thomas Rodd, chief engineer Pennsylvania Lines West; C. H. Hudson, chief engineer Southern, and P. A. Peterson, then chief engineer Canadian Pacific. The early recognition of a unity of interest between the United States and Canada possibly has had much to do with the lively interest in the association which has always characterized its Canadian members, and which has again been recognized in the presidential honor conferred upon William McNab, who has just finished his term of office.

At the Buffalo meeting J. F. Wallace was elected president, L. C. Fritch was confirmed in his election as secretary, and a form of constitution and by-laws adopted in substantially the same form as they exist to-day. To the unusual capability of Mr. Wallace as a presiding officer during the three terms he served, and to the loyal support given by his colleagues named and some others, are largely due the rapid acceleration which marked the early progress of the association. At its first professional session its proceedings were characterized by all the vim and vigor displayed by any similar organization regardless of age, and its course since has been uniformly progressive. The association easily ranks first among railway organizations in the ability of its membership and the authoritative nature of its proceedings.

The men who have so ably filled the presidential office are, in order: John F. Wallace, George W. Kittredge, Hunter McDonald, A. W. Johnston, Howard G. Kelley and William McNab. Walter G. Berg, who was from the first one of the most hard-working and efficient members, was elected to the presidency, but died before the meeting at which he would have presided, and he was succeeded by Mr. McNab, who was subsequently elected to a second term on his own

HUNTER M'DONALD,
Past President.

HOWARD G. KELLEY,
Past President.

A. W. JOHNSTON,
Past President.

account. In Mr. Berg the organization lost one of its strongest supports, and the workings of his keenly analytical mind appear in almost every matter that has emanated from the board of direction, and in many of the more important reports.

At the Buffalo meeting P. Alex. Peterson and W. G. Curtis were elected vice-presidents. Curtis died in the early years of the association's history and increasing age compelled Mr. Peterson to retire from the active chief engineership of the Canadian Pacific and from continuing his former activity in the affairs of the association. He still retains his "No. 7" and is consulting engineer of the same road. W. S. Dawley was elected treasurer at the same meeting and was regularly reelected until the present, prior to which time his resignation was presented owing to his having connected himself with a railway in China. He is succeeded by C. F. Loweth.

The Buffalo meeting established a board of direction consisting of W. H. McFarlin, then of the Chicago, Rock Island & Pacific; Hunter McDonald, then as now chief engineer of the Nashville, Chattanooga & St. Louis; D. J. Whittemore, chief engineer Chicago, Milwaukee & St. Paul; F. H. McGuigan, now retired from railway service, then chief engineer Grand Trunk; A. Torrey, then chief engineer Michigan Central, since deceased, and Thomas Rodd, then as now chief engineer of the Pennsylvania Lines West—"No. 4."

Among the past presidents who are named above, some have changed their connection or title—promotions all. Wallace became general manager of the road he knew so well, then chief engineer for the Isthmian Canal Commission, which nobody knew well before, then president of the Electrical Properties Company, which pays better and is more certain; McDonald, he sticks, because engineering is the most important part of a road that runs in the vicinity of the "Great Smoky Mountains," and, to apply the language of one of Mr. McDonald's stories when he was elected president, he is the "hell-roarer" of that same country—in engineering, not preaching, because he hasn't the "woice;" Johnston, he's general manager now; Kelley has switched from the Minneapolis & St. Louis to the Grand Trunk and is chief engineer of that system; and McNab is his principal assistant—another bond between the two countries that Nature made to be one; and Kittredge is chief engineer of a great system when once he was of only a part.

In the course of this account it has not become necessary to mention anyone who has taken steps backward. Chief engineers have become general managers, engineers of small lines have been placed in charge of large systems because they had many talents, and the few columns of a weekly journal became first a paper half an inch thick and then three-quarters and then a daily. The only answer is the old Latin quotation, "Tempora mutantur, et nos mutamur in illis." It answers the question, "Why is a Daily?"

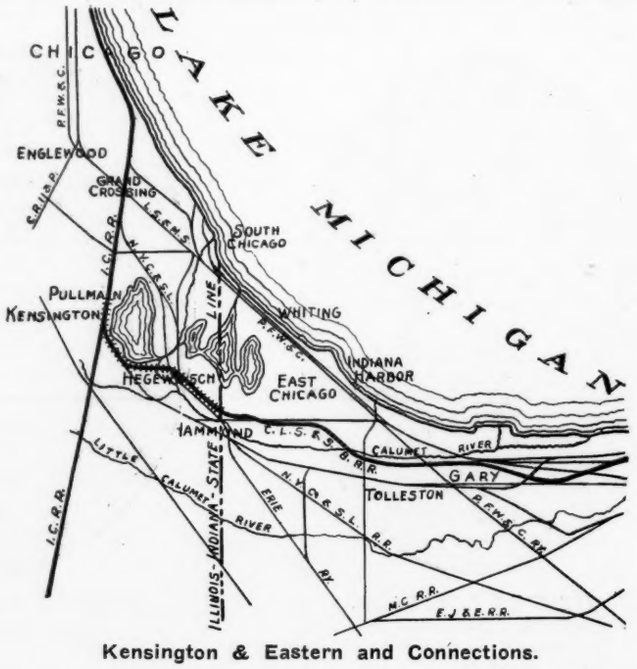
THURSDAY REGISTRATIONS.

Barnes, O. F., Div. Eng., Erie R. R., Susquehanna, Pa.
Beahan, Willard, Asst. Eng., L. S. & M. S. Ry., Cleveland, O.
Cleveland, G. C., Asst. Ch. Eng., L. S. & M. S. Ry., Cleveland, O.
Davis, C. S., Consulting Eng., Toledo, O.
Everham, A. C., Asst. Tun. Eng., D. R. T. Co., Detroit, Mich.
Paquette, C. A., Asst. Ch. Eng., C., C., C. & St. L. Ry., Cincinnati.
Pfafflin, E. H., Ch. Eng., S. I. and Ch. Sou. Rys., Chicago.
Ramsay, J. P., Receiver C., P. & St. L. Ry., Springfield, Ill.

DESCRIPTION OF THE CONSTRUCTION WORK ON THE KENSINGTON & EASTERN.

The sections of northeastern Illinois and northwestern Indiana near the shores of Lake Michigan, embracing Chicago and the towns eastward to Michigan City, although already traversed by numerous important steam railway trunk lines, furnish a most promising field for interurban development. The growth of the industrial city of Gary under the influence of the Indiana Steel Co. created a necessity for a frequent train service to Chicago, which could be most economically secured by the operation of an electric line.

About five years ago a syndicate of Cleveland capitalists obtained the franchise for an electric line from South Bend, Ind., to the Illinois-Indiana state line near Hammond. An arrangement was made with the Illinois Central for the construction of a connection from the state line to Pullman, Ill. At Pullman the business is transferred to the Illinois Central suburban trains for delivery to stations reached by that service. The section of the line in Indiana, approximating 71 miles, was built under



Kensington & Eastern and Connections.

the name Chicago, Lake Shore & South Bend; that in Illinois, approximating seven miles, by the Illinois Central, under the name Kensington & Eastern. Construction work was begun in the early part of 1907, and the electric railway was put in operation on April 4, 1909, and is known as the "South Shore Route." This description is limited to the features of the Kensington & Eastern.

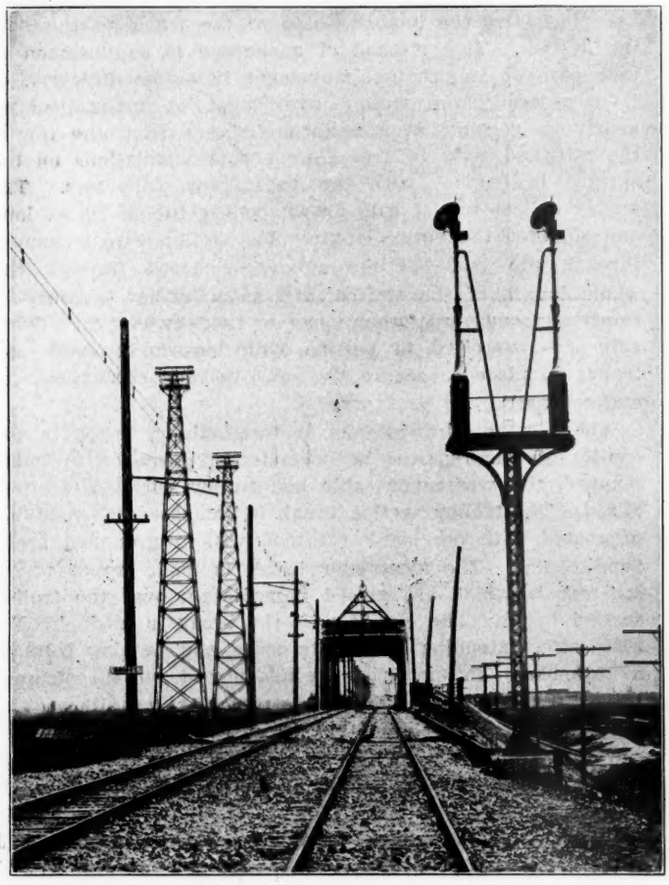
Two tracks were built on this section on 14-foot centers. One is leased to and operated by the Chicago, Lake Shore & South Bend for its suburban service between Pullman, Ill., and South Bend, Ind., and the other is reserved for steam service. Provision was made in the purchase of property and the design of structures to construct second tracks for both the electric and steam service whenever business demands additional facilities.

At present there is no steam service. The Chicago, Lake Shore & South Bend, on the track leased to it, operates 26 trains each way between the hours of 4:40 a. m. and 12:05 a. m. The time interval between trains varies from 30 minutes to one hour, with an average schedule of one train each way every 47 minutes. The motor equipment used is designed to develop a speed of 65 to 70 miles an

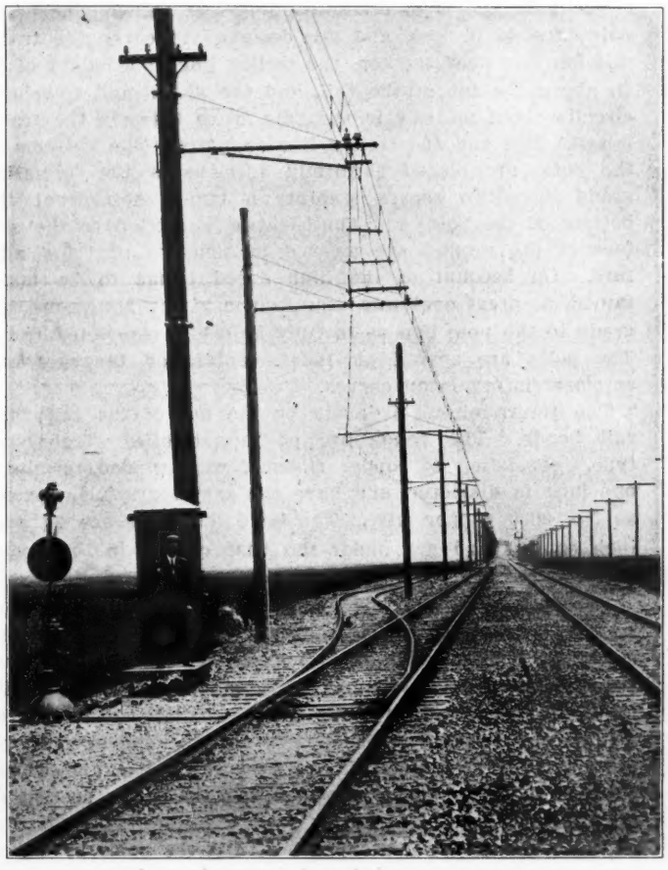
hour, but the average speed of the limited cars probably does not exceed 40 miles an hour.

The northern terminus of the Kensington & Eastern is at Pullman, Ill. From this point to Kensington the line occupies the right of way of the Illinois Central; from Kensington the line diverges to the southeast, parallels the southern shore of Lake Calumet, crosses the Grand Calumet river, the lines of the New York, Chicago & St. Louis, the Chicago & Western Indiana, and Pennsylvania near Hegewisch, and the Indiana Harbor Belt near Hammond. The entire line lies within the corporate limits of Chicago and the village of Burnham.

The country traversed is level and not more than 10 ft. above the level of Lake Michigan. The location of a line at this time in a city like Chicago, if reasonable construction cost is considered, will, in a great measure, be determined by the prices demanded for real estate, density of



Calumet River Drawbridge, Looking East.



Overhead Construction, Parsons Siding.

population, occupation by industrial concerns, street improvements, probable conversion of unimportant navigable streams into deep waterways of first importance, and the probable future street grade separation. On account of the complex conditions it was found necessary to make accurate surveys of the entire section traversed and careful studies of detailed estimates of cost on many alternate routes, due respect being given to the limitations fixed by public authorities having jurisdiction over the crossings of other railways, the crossings of navigable streams, and the crossings of streets, alleys and public places. These matters were given careful consideration, as well as the resultant effect of the construction and operation of a high voltage single phase alternating system upon abutting property and public utilities before permits and ordinances were requested. This part of the work extended over a two-year period.

On account of the high value of real estate it was found economical to haul sand for fills, approximately 650,000 cu. yds., from Dune Park for all the work. Between Kensington and the Grand Calumet river a temporary track was laid on the ice across the swamp from which the embankment was brought to the grade line. From the Grand Calumet river to Hegewisch the embankment was made from a temporary trestle built on the center line between the two tracke and to the formation grade line. The sand was hauled in Haskell & Barker gondola cars, unloaded by Lidgerwood machines and widened to the standard cross section by Jordan spreaders.

The most important bridges on the line are the structures over the Grand Calumet river and the overhead crossing of the New York, Chicago & St. Louis and the Chicago & Western Indiana. The former is a double track swing draw 228 ft. in length, supported by a hollow concrete, reinforced circular center pier and two concrete abutments. The foundations for the pier and abutments are placed sufficiently low to provide for the future 24-ft. waterway. The steel superstructure is of through type; the riveted trusses are spaced 30-ft. centers and rest on a steel drum 30 ft. in diameter. The bridge is equipped with modern electrical turning machinery and provision has been made for taking current from the electric railway's trolley circuit.

The overhead railway crossing consists of a double track viaduct approximately 715 ft. long. The tracks of the Kensington & Eastern, which are on a 4 deg. curve, cross two tracks of the New York, Chicago & St. Louis on tangent and two tracks of the Chicago & Western Indiana on a 5 deg. curve. The portions of the structure over the existing tracks and over the spaces for future tracks consist of through girders with I-beam floors and concrete water-proofed decks supported on towers made up of columns and cross girders. The portions of the structures from the abutments to the through plate girder sections

consist of deck girders, water-proofed concrete decks supported on columns and cross girder towers. The entire superstructure rests on reinforced concrete. Provision is made in both masonry and steel superstructure for the construction of an additional track on both sides of the existing structure.

The tracks are constructed for two types of service. The one for the steam service is laid with 85 lb. rails, with 6 in. x 8 in. x 8 ft. 6 in. ties on 20-in. centers. The one for electric service is laid with 70 lb. rails, with the same tie spacing. Both tracks are surfaced on 10 in. of furnace slag, uniform in size, the largest pieces passing through a circular iron ring three inches in diameter.

The single phase installation in connection with the section in Indiana is one of the important ones operating in the United States. In designing the installation the best practice was adopted, the materials used were tested and the construction is most substantial.

The pole line is of creosoted long leaf yellow pine. The poles are 45 ft. long and are designed to carry the transmission line near the top, the trolley line at a height of 22 ft. above the top of the rail, and the signal and telephone circuits about midway in the pole space between the transmission line and the trolley line supports. The bottoms of the poles are placed uniformly 6 ft. below the formation grade line. To secure stability a two-ft. section at the bottom of the pole, and another two-ft. section at the surface of the ground are incased in concrete of 1:3:6 mixture. On account of the high speed traffic to be maintained, as great care was exercised in giving alinement and grade to the pole line as to fully ballasted completed track. The poles are spaced on 166-ft. centers on tangents and at closer intervals on curves.

The return circuit is made by the use of the rails and rail bonds. The bonds are of the so-called "foot bond type," consisting of copper ribbons, with welded terminals one inch in diameter, and have the same carrying capacity as No. 0000 copper wire. The bond terminals are on five-inch centers and are under the base of rail in the space between the ties of suspended joints.

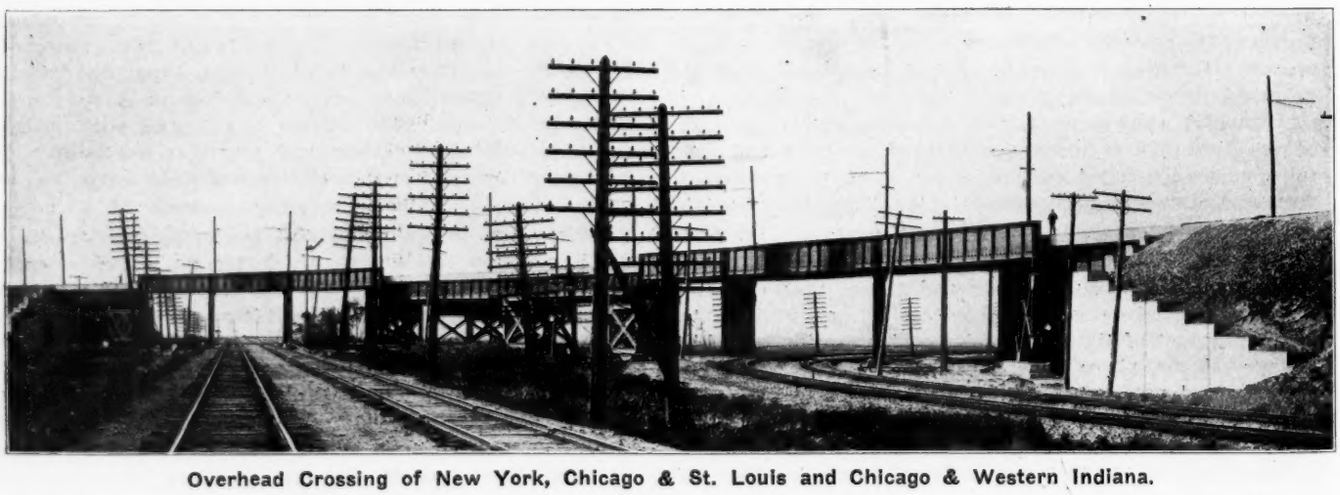
The trolley wire throughout is No. 0000 C. E. grooved section, supported by a half-inch, stranded steel, extra strength, double galvanized, messenger cable, which assumes a catenary curve and has a maximum sag of 18 in. for a pole spacing of 166 ft. The immediate connection of trolley wire to steel cable is by a half-inch galvanized iron rod provided with sister hooks over the cable, and a mechanical screw wedge clamp engaging the upper section of the trolley wire.

The catenary cable is supported from the poles by T-iron brackets, the outer end being fastened by half-inch overtruss rods. The insulator pins are of iron, the sockets of which engage the T-iron bracket; they are held in position by set screws, and are easily adjusted to take care of any irregularities which may develop in the alinement of the catenary system. The catenary system is supported on the pole brackets by high-tension porcelain insulators, tested to 20,000 volts. To secure stability and at the same time some elasticity, the iron bracket pins were wrapped with rubber tape before applying the catenary insulators. In case of impact to the catenary system the shock is absorbed by the rubber cushion and the loss of insulators by breakage is minimized. In addition to the vertical support for the trolley wire, lateral stability is obtained by means of an insulated wood steady strain placed at every pole. The trolley wire and messenger cable are anchored at the ends of curves and at half-mile intervals on tangents. The anchorage is V-shape in plan. The trolley poles serve as supports for one side and additional poles are placed on the opposite side of the track to complete the system. This method of anchorage is so designed to take care of longitudinal movement in either direction.

Of necessity the trolley wire must be maintained as nearly as possible at a uniform distance from the top of the rail, and must be free from abrupt undulations on the surface in contact with the pantagraph collectors. The trolley splices are of cold drawn copper tubing 36 in. long and soldered the entire length. The trolley wire is passed through the ends of the splices, soldered through the whole length of the splices, and as a further measure of safety the ends are either upset or held by clamps. Great care was exercised in putting both messenger cable and trolley in place to secure the same tension throughout its entire length.

Where, as at drawbridges or terminals, a break in the continuity was required as necessity of operation or maintenance, the messenger cable and trolley wire are sectionalized. The trolley section break is composed of wood impregnated with oil, being provided with a grounded brass band center. The messenger break is made up of porcelain spools which are placed immediately over the trolley section break. The circuit past the break is made by No. 0000 wire, extending from both sides and passing through a knife-blade disconnecting switch placed on the nearest trolley pole. Under ordinary operating conditions the switches are kept closed, but in case of trouble the line can be sectionalized by the men in the field and thus protect men engaged in making repairs from the 6600-volt trolley circuit.

The feed wire, return wire, telegraph, telephone and signal wire for the electrical installation at the Grand Calumet river crossing are supported on steel towers suf-



Overhead Crossing of New York, Chicago & St. Louis and Chicago & Western Indiana.

ficiently high to carry all wires 125 ft. above the mean level of the water. It was deemed advisable to adopt this plan of crossing rather than that of placing insulated armored cable below the bed of the stream. The stream now is a narrow channel and navigable by boats of light draft. If a cable crossing had been installed, future widening and deepening of the channel would cause serious interruption to traffic.

The circuit on the drawbridge is of special design and so made as to offer no interference with the opening or closing of the swing draw. The shore end of the messenger cable and trolley are supported by steel columns with knee brace stiffeners resting on masonry. The drawbridge ends are supported by structural steel columns and lattice girders founded on the end posts of the swing bridge. In this way both shore and drawbridge ends of the operating trolley circuit are maintained in a fixed position, subject only to such variations as arise from the expansion and contraction of steel in the supports. A space of 2½ in. is provided between the shore and drawbridge supports. With the drawbridge closed the continuity of circuit is made by spring copper bus-bars having a wiping contact surface of 4 in.

Power is generated at the Chicago, Lake Shore & South Bend plant at Michigan City, Ind. There are no substations on the Kensington & Eastern section.

Commodious station buildings, designed for suburban service, have been constructed at Pullman, Kensington, Hegewisch and Burnham. The stations are provided with steam heat and lighted by current from the trolley system. The station platforms are the same elevation as the car floors, and have easy approaches to the streets.

The design of the electrification details was under the direct supervision of W. E. Davis of Cleveland, Ohio, and the general supervision of all work was by A. S. Baldwin, chief engineer of the Illinois Central, and D. J. Brumley, principal assistant engineer, who was in charge of the work.

THE HUDSON BAY RAILWAY PROJECT.

The deputy minister and chief engineer of railways and canals of Canada finds "considerable difficulty in deciding on what basis to provide accommodation for a railway that in the nature of things cannot be operated to its capacity for more than two months in a year, to a lessened extent for a possible three months and for the remainder of the year still less."

Two routes for the Hudson Bay Railway have been surveyed, one from Pas Mission to Port Churchill on Hudson bay, 477 miles; the other from Pas Mission to Port Nelson, southeast of Port Churchill, on Hudson bay. The Nelson route follows the route laid out for the Churchill road for 150 miles and then branches off to the east. It is 440 miles long. The cost of surveying these routes has been $130,716, up to September 30, 1909.

The reasons for building a Hudson bay railway have often been discussed. They are partly military and partly sentimental. The report of the deputy minister and chief engineer of Canada attempts to in part justify such a road by showing what traffic may be developed. He points out that a line drawn from Dauphin, Man., in a southwesterly direction, passing through Weyburn, Sask., will separate the territory tributary to Pas from that tributary to Port Arthur on Lake Superior. He estimates that nearly the whole of the province of Manitoba and about 11,000 square miles of the southeast corner of Saskatchewan is tributary to Winnipeg. The whole of the remaining area of Saskatchewan and of Alberta belong to Pas Mission. He thinks that the country tributary to Pas is as fertile and as capable of production of agricultural products as is North and South Dakota.

The first 150 miles of the railway would run through well timbered country and the greater part of both the Churchill route and the Nelson route would be in a country where there is thought to be considerable mineral wealth. Limestone is found in large quantities and is favorable for quarrying, and marble is found in fair quality at Port Churchill and in good quality on Marble island in Hudson bay. It is pointed out in the report that there are a number of varieties of fish of good quality in Hudson bay, and if the new line were built fresh fish could be brought to the inland towns of Manitoba and Saskatchewan in 24 hours. It is hoped to develop some export and import traffic by means of a steamship connection with Liverpool. The steamship route would pass north of Ireland and the distance from Liverpool to Port Nelson is 3,200 miles, as against 3,007 miles from Montreal to Liverpool.

The report of the chief engineer favors the Nelson route. The road could be built from Pas Mission to Nelson with a maximum grade of 0.4 per cent. and with an average curvature per mile of about five deg. 30 min. Gravel and sand have been found in sufficient quantities along the surveyed route to justify the belief that ballast may be had without long hauls. There are no large bridges necessary on the Churchill route. On the Nelson route there would need to be three important bridges, one crossing the Saskatchewan river and two crossing the Nelson river.

The total estimated cost of building the Churchill line, if laid with 80-lb. rails, is $11,351,520. In addition, it would cost about $7,757,152 for stations, terminals, yards, etc. The cost of the Nelson line, laid with 80-lb. rails, is estimated at $8,981,800, stations, yards, etc., being estimated at $7,444,540 additional.

The line on which these estimates are made is designed to handle 32 trains a day, hauled by Mallet articulated compound locomotives, each train being made up of 40-ton capacity cars. This would permit moving 64,000 tons a day, allowing 50 per cent of the total mileage for empty car mileage.

Such a line as the one from Pas Mission to either Nelson or Churchill could not be operated profitably as an independent line and probably would have to be operated by one of the other large systems, the Grand Trunk Pacific, or possibly the Canadian Northern, might, for some reasons not directly connected with profit, find it advisable to operate such a line to Hudson bay.

IMPORTANCE OF THE COLISEUM EXHIBIT.

The following circular is of considerable interest:

New York Central Lines.

Circular No. 843.

Cleveland, March 9, 1910.

All Roadmasters and Master Carpenters, L. S. & M. S. Ry., D. A. V. & P. R. R., L. E. A. & W. R. R.

The Road and Track Supply Association will give exhibition of railway appliances used in the construction, maintenance and operation of railways at the Coliseum, Chicago, Ill., March 14 to 19, 1910.

This exhibition is very interesting to the engineering department, and I would suggest that each of you spend one day there, advising me in the regular way what day you wish to be off your division.

While some of the manufacturers have sent out formal invitations, I am advised that such invitation is unnecessary and that you will be admitted on presenting your railroad pass.

G. C. CLEVELAND,
Assistant Chief Engineer.

If every road in Chicago territory should issue similar instructions next year, the best current ideas in maintenance work would have a chance to spread very rapidly.

Proceedings

The Thursday morning session of the American Railway Engineering and Maintenance of Way Association was called to order at 9:40 o'clock by President McNab.

BUILDINGS.*

The committee was divided into three sub-committees, as follows:

Sub-Committee A: Maurice Coburn, chairman; H. M. Cryder, C. H. Fake, P. F. Gentine.

Sub-Committee B: William T. Dorrance, chairman; George W. Andrews, M. A. Long, C. H. Stengel.

O. P. CHAMBERLAIN,
Chairman Committee on Buildings.

Sub-Committee C: E. N. Layfield, chairman; John S. Metcalf, L. D. Smith, O. P. Chamberlain.

The topics submitted to the committee by the board of direction were as follows:

(1) Consider revision of Manual; if no changes are recommended, make statement accordingly. (Considered in full committee, afterward referred to Sub-Committee A.)

(2) Report on the use of reinforced concrete for coaling stations and storage bins. (Proceedings, Vol. 10, Part 2, page 1109. Sub-Committee C.)

(3) Continue the investigations on the design and detail arrangements of oil houses at terminals. (Proceedings, Vol. 10, Part 2, pp. 1124-1128. Sub-Committee C.)

(4) Recommended conditions under which various types of roof coverings are desirable. (Sub-Committee A.)

(5) Submit recommended designs for section tool houses applicable to roads of classes A, B and C. (Sub-Committee B.)

Revision of Manual.

The committee submits the Recommended Practice proposed and present on opposite pages for convenience of comparison. The proposed changes are to eliminate discrepancies and repetitions and present the recommendations in a more orderly fashion. It has not deemed it within its province under topic (1) to make radical changes in the Manual.

The changes submitted may be summarized as follows:

Waiting Rooms in Local Passenger Stations.

Omit paragraph (8).

The floor plans shown in the 1905 Manual, which are to be inserted in the new Manual, are altered so as to have a bay window in the telegraph office, giving the operator a view up and down the track.

Enginehouse Design.

Turntable.

Insert: "If electric power is used, the wires should be carried in a conduit up through the center of the pivot masonry and the turntable center."

Turntable Pit.

Change to read: "The side walls of the turntable pit should be of concrete or brick," etc., brick being sometimes cheaper than concrete and entirely satisfactory.

Omit: "Pivot masonry may be of concrete with stone cap." The stone cap for pivot masonry is not necessary, reinforced concrete being satisfactory.

Omit: "The distance from center of turntable to the inner side of roundhouse should be determined by the number of stalls required in the full circle."

Door Openings.

Change to: "The clear opening of entrance doors should be not less than 13 ft. in width and 16 ft. in height." The present 12-ft. width is not sufficient to avoid chance of injury to employees; and the present 17-ft. overhead clearance may be desirable, but it is not necessary.

Materials.

Insert the following (from Bulletin 103, p. 19):

"Reinforced concrete should be used below the floor when it is cheaper than plain concrete.

"The additional security against interruption to traffic from fire warrants the serious consideration of the use of a reinforced concrete roof.

"When the roof is of reinforced concrete the columns and roof beams should be of the same material.

"Reinforced concrete should be used for the walls only where special conditions reduce its cost considerably below that of brick or plain concrete."

Smoke Jacks.

Committee has cut out all reference to damper, and expressed size of flue in square feet of sectional area.

Drop Pits.

Last clause in present recommendation ("These can be most economically constructed in pairs") is not always true. Three pits are more economical than two, in some cases.

Heating.

Insert conclusions adopted at convention last year.

Window Lights.

Insert the following (from Bulletin 103, p. 19):

"The disadvantages of roof lights are so much greater than their advantages as to make them undesirable.

"Windows in the outer walls should be made as large as practicable and contain the largest glass or light area consistent with the requisite strength. In general, the lower sill should be not more than four feet from the floor and only sufficient space left between pilasters and sides of window frames and girders and window heads to properly secure the window frames. Windows or transoms as large as practicable should be provided over all doors where locomotives enter, but where possible to avoid it window lights should not be placed in doors on account of difficulty of maintenance."

Electric Lighting

Change to: "For general illumination there should be an arc lamp or something equally efficient in each space between stalls. There should also be plug outlets for incandescent lamps in each alternate space between stalls." The Manual specifies arc lights only; also plugs for incandescents in each space. The arc lamp has competitors, such as the Cooper-Hewitt lamp, which gives evidence of being efficient for this purpose. Plug outlets in alternate stalls, if sufficient in number, are satisfactory. The difficulties in maintaining electric wires in an enginehouse make it desirable to cut down their total length as much as possible.

Piping.

Change to: "The contents of boilers should not be blown off into the house and engine pits, but by means of a blow-off pipe should be carried to a suitable receptacle and used for heating refilling and washout water. The refilling water and the washout water should be maintained at the same temperature in different parts of the house and under suitable pressure by means of pumps and return circulating lines. As necessary, the blow-off steam and water can be supplemented by steam from the power plant and additional water. The use of warm water for washing out and refilling considerably reduces the cost of boiler maintenance and the time necessary for a washout or change of water." Present Manual specifies handling of cold water only, and merely mentions the desirability of hot water.

"Compressed air with from 80 to 100 pounds pressure which can be used for operating air tools and also for hoists and blowing and steam with 100 pounds pressure for use in raising boiler pressure should also be provided. The steam outlet is needed near the front end of the boiler and

*From a report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

the incandescent light plugs; the blow-off pipe, the air, the washout and refilling water, and the cold water connections, should be near the front end of the firebox. Connections need only be provided in alternate spaces between stalls." This simplifies the present recommendations. The overhead compressed outlet is not considered necessary, and connections in alternate stalls are considered satisfactory.

Hoists.

The committee calls attention to the fact that, besides air, hoists or cranes with differential blocks there are other cranes not operated by air in successful use, such as jib cranes on the front post or a trolley around the house near the outer wall.

Power Plant.

Insert: Where circumstances permit, the efficiency of the power plant can be increased by using the locomotive water supply for condensing purposes.

Locomotive Coaling Stations.

Insert (from Bulletin 103, p. 18): "In figuring the cost of handling coal, there should be included charges for interest and depreciation, charges for maintenance and operation (the cost of switching cars on to trestles should be included) and a charge for the use of the cars for storage purposes."

Oil Houses.

Insert the conclusions adopted last year.

Reinforced Concrete Coaling Stations.

Plans and photographs of four reinforced concrete plants recently built are shown in the committee report.

While it has been difficult to obtain data as to comparative costs of reinforced concrete stations and timber structures, the committee sees no reason to change the opinion previously expressed that the cost of the reinforced concrete structures averages about 50 per cent. greater than that of timber structures of like capacity.

It would seem that the use of the reinforced concrete type of coaling stations and storage bins is increasing. In many cases, no doubt, the freedom of this type from the danger of the loss of the structure and contents by fire due to spontaneous combustion of soft coal will cause many engineers to install one or more of those structures so that they may have a practical test of their efficiency.

The committee does not present any recommendations for the general adoption of this type of coaling stations and storage bins.

Oil Houses.

The committee has revised the typical oil house cross-section shown in last year's report to correspond with the following additional conclusions:

(5) Openings for ventilation should be provided above the level of the top of the tanks.

(6) Lighting, when practicable, should be by electricity and heating by steam.

Roof Coverings.

The committee does not present definite recommendations. The following is given as a progress report:

Tile.

A roof of well-burned tile properly laid is probably unexcelled for a pitch of six inches or more to the foot. It is so heavy in appearance that it ordinarily does not look well on a frame building.

Slate Roof.

A slate roof is cheaper in cost and lighter in weight than tile. It will give results almost as good and can be used satisfactorily on wooden buildings. The pitch should not be less than for a tile roof.

Wood Shingles.

A wood shingle roof properly laid and of good material will last for many years. First-class shingles can still be obtained from the Pacific coast for a reasonable price. If the shingles are dipped in linseed oil or creosote their life will be considerably increased. Painting after laying induces decay and should be avoided. When the roof is old and a little out of shape it is somewhat dangerous, providing a chance for the lodgment of sparks. The pitch should be at least six inches to the foot.

Built-Up Roofs.

Roofing built up of felt saturated with coal tar, cemented together with coal-tar pitch and covered with a protective coating of gravel or slag has shown by long experience its great serviceability for flat surfaces.

The following specifications give what is considered good practice in the laying of such roof coverings over boards and over concrete, the first specification being designed for roofs having an incline not exceeding three inches to the foot:

Specifications for Five-Ply Tar and Gravel or Slag Roof.
(Over Boards).

(To follow description of roof sheathing.)

Over the foregoing shall be laid a coal-tar pitch, felt and gravel or slag roof.

There shall be used one thickness of sheathing paper or unsaturated felt, five thicknesses of saturated felt weighing not less than 14 pounds per 100 sq. ft., single thickness, and not less than 120 pounds of pitch, and not less than 400 pounds of gravel or 300 pounds of slag from ¼ to ⅝-in. in size free from dirt, or 100 sq. ft. of completed roof.

The material shall be applied as follows: First, lay the sheathing or unsaturated felt, lapping each sheet one inch over the preceding one. Second, lay two full thicknesses of tarred felt, lapping each sheet 17 in. over the preceding one, and nailing as often as may be necessary to hold the sheets in place until remaining felt is applied. Third, coat the entire surface of this two-ply with hot pitch mopped on uniformly. Fourth, lay three full thicknesses of felt, lapping each sheet 22 in. over the preceding one, mopping with hot pitch the full width of the 22-in. lap between the plies, so that in no case in the last three plies shall felt touch felt. Such nailing as is necessary shall be done so that all nails will be covered by not less than two plies of felt. Fifth, spread over the entire surface of the roof a uniform coating of pitch, into which, while hot, imbed the gravel or slag. The gravel or slag in all cases must be dry.

The following specification is designed for roofs having an incline not exceeding one inch to the foot, and by adding the words "such nailing as is necessary shall be done so that all nails will be covered by at least two plies of felt," the specification is suited for inclines not exceeding three inches to the foot:

Specifications for Five-Ply Tar and Gravel or Slag Roof.
(Over Concrete).

(To follow description of concrete, which should be smooth and perfectly graded to carry water to outlet or gutter.)

Over the foregoing shall be laid a coal-tar pitch, felt and gravel or slag roof.

The specification is similar to the previous one, except that the sheathing paper is omitted, and 200 pounds of pitch is specified instead of 120 pounds.

The material shall be applied as follows: First, coat the concrete with hot pitch mopped on uniformly. Second, lay two full thicknesses of tarred felt, lapping each sheet 17 in. over the preceding one, and mop with hot pitch the full width of the 17-in. lap, so that in no case shall felt touch felt. Third, coat the entire surface with hot pitch, mopped on uniformly. Fourth, lay three full thicknesses of felt, lapping each sheet 22 in. over the preceding one, mopping with hot pitch the full width of the 22-in. lap between the plies, so that in no case shall felt touch felt. Fifth, spread over the entire surface of the roof a uniform coat of pitch, into which, while hot, imbed the gravel or slag. The gravel or slag in all cases must be dry.

The felt is saturated with tar from which the water and more volatile oils have been removed. The pitch is coal tar from which the creosote oils have been distilled. The pitch should be so soft that it can be used at all times without the addition of coal-tar or oil on the work, and yet so hard that it can be easily handled in warm weather. The best pitch for use in Winnipeg would not be satisfactory in New Orleans. If the pitch is too soft, it will run and the coating cannot be made thick enough. If too hard, or if used in too small quantity, the gravel will not stick. The gravel acts as a protection to the surface from walking on the roof, and from the action of the sun, and also keeps the pitch from running. The gravel of the sizes specified is supposed to give the greatest amount of protection to the pitch, without being in danger of washing off. The sheathing paper or unsaturated felt placed on the bottom next the roof boards is mainly to keep any pitch which might penetrate the two-ply felt above it from cementing the roofing to the roof boards. It also is of value in preventing the drying out of the roof through open joints from below. The saturated felts should be nailed when there is any chance of disturbance of the roof from underneath by wind and also enough to hold it in place while laying. The practice in regard to nailing varies in different parts of the country. Better results can be assured if matched sheathing is used. The two layers of saturated felt first laid are necessary in order to carry the amount of pitch which must be handled in one mopping.

After the original two layers of saturated felt are used, the additional layers are merely to give additional thickness of wearing material, and with a roof properly laid, the greater the amount of felt and pitch used the greater

the life of the roof. Ten-ply roofs have been laid. If too much pitch on top is used, it will run. The flatter the roof, the greater the life.

There are several grades of tar sold—the old-style strictly coal-gas tar, the tar from by-product coke ovens and the tar from the oil used in enriching water gas. Their value for roofing purposes is assumed to be in the order named. The oil tar is supposed to contain volatile oils which evaporate gradually, leaving the residue brittle. The increasing value of and the demand for creosote and other available residues of coal tar, with the attendant increase in the number of by-product plants, is increasing the output of coal tar.

It should be understood that there is a considerable variation in the quality of the tar produced, both in the by-product plants and from the gas houses. Good coal-gas tar can be bought under the guarantee of reputable manufacturers.

The inspection of a built-up roof is a difficult matter. The National Association of Master Gravel and Slag Roofers of America is endeavoring to insure the construction of good roofs. It recommends specifications about as follows:

"Labels.—All pitch and felt used on this work shall bear the manufacturer's label, and the felt shall also bear the manufacturer's label, stating the minimum weight per 100 sq. ft., single thickness.

"Inspection.—The architect reserves the right to inspect the roof by cutting a slit not less than three feet long at right angles with the way the felt is land before the gravel is applied."

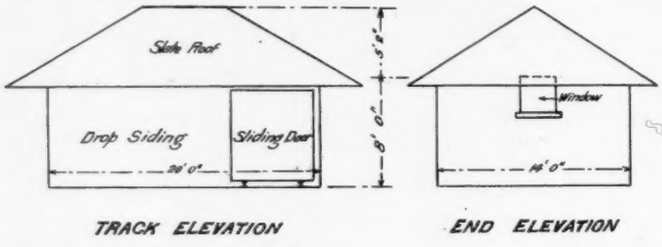
One arrangement suggested to insure the specified quantity of materials is to weigh all materials which come to the work and insist on the proper amount being used. No specifications for coal-tar pitch and saturated felt are available, and the only assurance of good quality is the guarantee of the manufacturer.

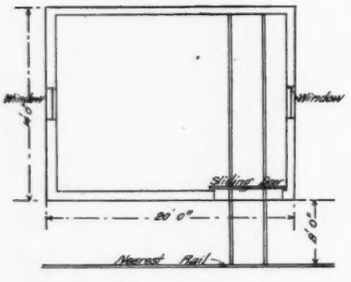
With a proper foundation, a coal-tar roof perfectly flat, covered with water, would theoretically have an indefinite life. Crushed material, such as quartz with rough edges, is better than routed gravel for covering steep slopes.

Asphalt is used for this purpose. It is variable in quality. It is claimed that its volatile constituents are so great that it deteriorates gradually. It seems to be relatively of more value for steep slopes than for flat surfaces.

Ready Roofing.

The roofings which come ready to lay are made on the principle of the built-up roof, but in a preparation which comes rolled it is impossible to get the amount of waterproof material deemed necessary for a good built-up roof. Asphalt is generally considered better for this purpose than coal tar.





Section Tool House for Class A Roads.

The committee report also shows plans for classes B and C. They are similar to class A, with the variations indicated in the specifications.

The weakness of this type of roof covering lies also in the exposed lap and nailing and in the narrow lap. These coverings are valuable because of their economy for small, isolated and temporary buildings. They do not require the expert help required for a built-up roof.

Tin.

A tin roof can be used for almost all slopes, and if properly and frequently painted, gives good results, where it is not exposed to locomotive gases. Its maintenance is, however, expensive. It can be easily damaged and it is not suitable for railway purposes except under special conditions.

Patent Shingles.

There are also on the market various types of metal and composition shingles. Reinforced concrete slabs from 5 to 6 ft. long have been used for this purpose. Corrugated iron, asbestos boards, asbestos protected metal and tin or galvanized iron shingles are among those offered for sale.

Section Tool House.

Your committee begs leave to submit the following conclusions as its recommendation for the three classes of roads, A, B and C:

Class A.

House, 14x20 ft., with long dimension parallel to track; house to have sliding door 8 ft. in clear at extreme end on track side to permit the storing of handcar.

Building to be on wooden posts, unless the location can be permanent, in which case brick or concrete piers may be substituted for posts.

Building to be covered with drop siding.

Roof to be slate or asbestos shingles. (It is considered especially dangerous to have the ordinary shingle construction on buildings of this type.)

Building to have window openings on two sides and sliding shutters. (No glass to be used in windows or doors.)

Class B.

House, 12x16 ft., with long dimension parallel to the track; house to have sliding door 8 ft. in clear at extreme end on track side to permit the storing of handcar.

[Remainder of specification is same as for Class A.]

Class C.

House, 10x14 ft., with the short dimension parallel to the track, with double swinging door, swinging out on the end nearest the track.

[Remainder of specification is same as for Class A.]

Conclusions.

(1) The committee recommends that the changes in the Manual, as set forth in the report, be approved.

(2) That the recommendations under the heading of oil houses be approved.

(3) That the report on roof coverings be received as information.

(4) That the designs for section tool houses be approved as good practice, and incorporated in the Manual.

The report is signed by: O. P. Chamberlain (Chi. & Ill. West.), chairman; Maurice Coburn (Vandalia), vice-chairman; George W. Andrews (B. & O.), H. M. Cryder (W. P. Carmichael Co.), William T. Dorrance (N. Y. C. & H. R.), C. H. Fake (Miss. River & Bonne Terre), P. F. Gentine (Mo. Pac.), E. N. Layfield (Chi. Term. Trans.), M. A. Long (B. & O.), John S. Metcalf (John S. Metcalf Co.), L. D. Smith (Sou Pac.) and C. H. Stengel (Virginian).

Discussion on Buildings.

O. P. Chamberlain (C. & I. W.): Your committee and the subcommittee, of which Mr. Coburn is chairman, has spent a great deal of time in the investigation of roof coverings, and we discovered how little we know about roof coverings. Mr. Coburn, particularly, has devoted a great deal of attention to this matter. He was called back to St. Louis last night and he told me that he was not entirely satisfied with the result of the work of his subcommittee and hoped that the matter would be referred back to the committee. We have conferred with the American Society for Testing Material, and we hope at some future time to be able to give the convention something definite as to what constitutes a good roof covering, and perhaps some recommendations as to what means shall be adopted by the engineer to ascertain whether he is receiving a good material or not. The more important revisions of the Manual are as follows: Beginning with page 142, the principal difference on that page is the omission, under waiting rooms and local passenger stations, of what was formerly No. 8. I don't think the station we recommend admits of architectural treatment, and the committee left that out. On pages 144 and 145 the designs for the stations are identical with those formerly adopted by the

committee, with the exception of a bay window. On page 147, under the present form, the turntable pit was to be of concrete only. We inserted "concrete or brick" because there are places where it is much more convenient to get brick and we believe it makes as satisfactory a pit wall. As to door openings, the former reading was that the clear opening of entrance doors should be not less than 12 ft. in width and 17 ft. in height. We substituted, "The clear opening of entrance doors should be not less than 13 ft. in width and 16 ft. in height." We did not regard a 12-ft. clearance as sufficient and we did not regard the 17-ft. clearance as necessary.

W. C. Cushing (Penna. Lines): I do not think the committee has gone quite far enough. I should like to see them made 14 ft. in width and 16½ ft. in height at least. State legislatures are passing laws on those subjects now, and we are going to be put to a great deal of expense to widen out and increase the clearances. It will be a mistake on our part to decrease the clearances. I move that we substitute 14 ft. for 13 ft. and 16 ft. 6 in. for 16 ft.

J. P. Snow (B. & M.): I am not much in sympathy with making that 14 ft. It would simply be an encouragement to the state legislatures, and other parties in power that Mr. Cushing referred to, to fix that as a minimum; and they may go one better. They may say this association has adopted that as good practice and everybody must come to it. I do not think we ought to encourage extreme clearances of any kind, because the various commissions, state and national, are apt to pick up these figures and go one better.

C. H. Fake (M. R. & B. T.): The committee had that in mind, and it inserted the words "shall not be less." If anyone wishes to have a wider door there is nothing here to prevent it. Some roads do not have as large engines as others, and they might want to build a house with doors less than 14 ft. wide. We thought 13 was ample for small engines, and it was put in that shape.

C. F. Loweth (C. M. & St. P.): It seems to me the requirements presented by the committee are ample and we will be on the safe side if we adhere to that.

G. H. Bremner (C., B. & Q.): I hope this motion will pass. It seems to me there is another side of this that we ought to look at, that is, the building of buildings by private parties. We frequently have to meet the question as to how wide and how high shall doorways and entrances be made. If we have 13 ft., we will have no argument whatever for making those entrances any wider, and we should not allow them to be made that narrow in private buildings.

Mr. Snow: Part of this applies to a roundhouse. Private parties seldom build a roundhouse.

C. E. Lindsay (N. Y. C. & H. R.): I agree that when we establish 13 ft. as the width of our engine house doors, we knock from under ourselves the support that we have for arguments with private parties. Our standard for such openings now is 14 ft., and I think we ought to have our engine house doors 14 ft. It means 10 ft. greater distance between the turntable and the face of the engine house.

Mr. Loweth: The standard on the road I am connected with is also 14 ft. for all our new houses, but we have a great many houses that we will continue in service a great many years where the opening is 13 ft., and in many cases less than 13 ft. It is admitted that it is desirable to have a wider opening, but we cannot bring about a wider opening in many of the old houses that many roads have in service. I think we should not put into our Manual a requirement that is going to give a black eye to perhaps nine-tenths of all the old houses in existence to-day and that will remain in existence a good many years. Mr. Bremner's argument, I think, is good, but it is unnecessary that we should put into our Manual many things that are otherwise not necessary simply to bolster up an argument when we have to deal with other buildings into which our locomotives are supposed to run. I think we should meet the situation by saying that our newer houses are built with such a width of opening and that we will decline to run our engines and cars into their houses unless they will conform to the present width of openings.

W. S. Thompson (Penna. R. R.): I think one thing we should remember is our past experience with equipment. We constantly enlarge the equipment, and we cannot foresee now the width we are coming to. The Baltimore & Ohio now has up this question of taking care of the new Mallet engines, and roundhouse doors will have to be provided to receive those engines.

Mr. Chamberlain: We are not advocating the adoption of 13 ft. width and 16 ft. height of entrance. That is the absolute minimum. That is the point, it seems to me, that some of the speakers have overlooked. I want to lay particular stress on that before the matter is brought to a vote.

The motion was lost.

Mr. Chamberlain: On page 148, under "roundhouse doors," we have omitted the first part of the first paragraph: "Roundhouse doors should be made of non-corrosive material." This same statement occurs about three times in the Manual. We decided to eliminate it entirely. If there is no discussion on that we will proceed to the smokejacks. The only material change is leaving out the recommendation that a damper be provided in the flue. There is a very decided opinion on that on the part of the engineers and we dodged it by eliminating it entirely. We also omitted "non-corrosive." I think that was brought up by Mr. Loweth last year. The next change is under "drop pits." The original reading will be found at the bottom of page 148. We left off the last sentence, because, as stated in the footnote, it is not true. As to electric lighting, the change was introduced to indicate that we did not consider the electric light absolutely necessary. There are some places where it would be impracticable to have electric lights, and there are others as satisfactory as electric lights. If there is no further discussion, I move that the revision of the Manual as presented by your committee be adopted for the new Manual.

Mr. Loweth: It seems to me that the specifications that have been presented by the committee are drawn primarily for a large and well-equipped house at an important terminal. I believe that a great many new houses are built for terminals where the engines will be simply turned around and little or no work done on them. Such houses will be of perhaps 10 stalls or so. These specifications are entirely too elaborate and call for too much equipment of such houses, and I think that some discrimination ought to be made in their favor. I move that we change the heading of these specifications to read, "Recommended Practice for a New House for Large Terminals." It seems that that is really what the committee had in mind.

Mr. Fritch: I wish to know if Mr. Loweth would change the word "large" to "important terminal"? It may not be a large terminal, but it may be an important one.

Mr. Chamberlain: The committee has no objection to that change being made. I think Mr. Loweth's point is well taken. Of course we did have in mind large engine houses.

Motion carried.

Mr. McDonald: As to the resolution just passed, it seems to me the committee has made a change in the Manual which they do not show. The title in the Manual under this heading is "Requirements of a Modern Roundhouse." The committee seems to have omitted that altogether. If that had been included it would have carried the meaning Mr. Loweth recommended.

Mr. Loweth: That would hardly fill the bill. A 10-stall house without air and drop pits and without heating and lighting, might be a modern house in every sense of the word, and one able to accomplish all the work required of it, but it would not comply with these specifications.

The report of the committee with regard to the revision of the Manual, as amended by Mr. Loweth's motion, was adopted.

Mr. Chamberlain: As to the use of reinforced concrete for coaling stations and storage bins, we have no recommendation to make for the Manual. I suggest that the board of direction refer the matter back to the committee for further consideration. There is, I think, a growing tendency to put in coaling stations of reinforced concrete, at least on trial, and so far as we have been able to learn those which have been installed are quite satisfactory. They are more expensive, but when the question of the possible loss due to fire is considered we figure out that they are more economical. We believe an engineer is justified in important terminals in installing this type of house on the ground that he cannot afford to have a fire which will upset his whole operating department.

As to the design and detail arrangements of oil houses at terminals, there are two recommendations presented by the committee which I think the secretary had better read.

The President: Before the secretary proceeds to read these sections, it is understood that the report on "Reinforced Concrete Coaling Stations" is received as information and referred back to the committee for further consideration.

The secretary read the conclusions referred to.

Mr. Loweth: I suggest that the second clause read: "Lighting, when required, should be by electricity, and heating by steam."

L. C. Fritch (C. G. W.): There is one point the committee has not covered in these specifications, and that is the ques-

tion of fire protection. It is customary in oil houses to put in a coil of steam pipe with a valve operated from the outside, so that in the case of fire the valve is opened. This is a great protection in the event of fire.

Mr. Chamberlain: The committee is willing to substitute "when required" instead of "when practicable."

The president put the motion on this substitution, which was carried.

Mr. Chamberlain: I do not know that that motion carries exactly what we wanted, and I would like to get the sense of the convention on the matter. I move that these two recommendations, 5 and 6, as adopted by this convention, together with the cross-section, Fig. 10, be incorporated in the Manual, and also that the further consideration of the matter of oil houses be referred back to the committee, especially in regard to the suggestion made by Mr. Fritch.

Motion carried.

E. N. Layfield (C. Ter. Trans.): The report on "Roof Coverings" is not regarded as entirely satisfactory, and as the chairman of the committee has stated, the committee desires to have it referred back for further consideration.

The President: I do not believe any discussion is necessary on that point. The committee is not prepared to discuss it to-day and we refer it back for further consideration. We now take up the question of section tool house.

Mr. Chamberlain: We present three sketches of section tool houses, together with recommendations, which I will ask the secretary to read.

Mr. Lindsay: Does the drawing of the Class B house agree with the dimensions in the first paragraph? The paragraph refers to a house 12 ft. by 16 ft. and the dimension on the diagram appears to be 18 ft.

Mr. Chamberlain: That is an error and we will correct it. The dimension on the diagram is incorrect.

The secretary read the paragraphs under Class A.

Mr. Loweth: I would like to inquire why these buildings are to be covered with drop siding instead of some other kind of finish which may harmonize with the other buildings about the station?

Mr. Fritch: I think Mr. Loweth's point is well taken. A lot of roads adopt standards that do not conform to this. A lot of roads use shingles. I suggest that sentence be omitted.

The President: The committee will omit that sentence.

Mr. Loweth: I move that the words, "Roof to be slate or asbestos shingles," be omitted. I see no reason why, if we desire, we should not put ordinary shingles on a building of this character. I object to putting in the Manual the statement that a shingle roof on a small building of this kind in any part of the country is dangerous.

Mr. Chamberlain: We have no objection to striking out this provision.

A motion to that effect was carried.

Mr. Fritch: As to the "Building to have window openings on two sides and sliding shutters. (No glass to be used in windows or doors.)" It is customery sometimes to have windows of glass arranged to slide out of the way. I do not see any necessity for putting in the matter in parentheses.

A. W. Thompson (B. & O.): That motion being carried, there is no mention made of the roof in the following specifications. I think it would be preferable to make some mention of some kind of roof. For instance, a roof of fireproof construction.

C. H. Stein (C. of N. J.): It seems to me that you have taken the sides out of this building and removed the roof and now you are about to eliminate that feature in regard to the windows. Where is the building going to come in? It has always seemed to me that it was the province of this organization to originate and not, necessarily, to imitate. The point was made a few moments ago that a great many roads adopt standards that would not be in conformity with what was composed here, therefore, it was not thought wise that we should place ourselves on record in regard to this matter.

During the discussion of the report of the Track Committee we made one of the most radical departures this organization has ever made, and that was with regard to the length of switches and numbers of frogs preferable to use, etc., asking us, in a great many cases, perhaps in the larger percentage of cases, to deviate entirely from the established plans that have been built up after years of time and consideration spent upon them. I do not see any more reason why in this case also you may not establish a standard for recommended practice, just as this convention, by its silence, permitted the Track Committee to establish new standards at variance with what railways have considered, generally, recommended practice for their government. I believe we should incorporate in our Manual certain features that would apply to a well-constructed building for the use of track foremen and section gangs, and I do not see any reason why this convention should not say what would make the best form of construction. That imposes upon no individual nor any railway the obligation to conform strictly to the recommended practice of this association. It is within the province of every railway to do as it sees fit, but this convention says by its vote and voice that this is the recommended practice. If a railway, in its wisdom, thinks well to depart from what this association declares as the best practice, no one can offer any objection to it. It seems to me entirely unreasonable and illogical that we should strike out this entire building, which we will do in effect, and in fact have done, if we strike out the various clauses that have been discussed.

G. W. Andrews (B. & O.): In striking out these clauses, you have eliminated the recommendations of this committee. The sub-committee having this particular subject in charge, of which I am a member, received a great number of answers to their request for information from various roads, and if your committee had endeavored to draw up a specification covering all the methods and so-called standards of the different railways, we would have filled a bulletin much larger than this one with specifications alone. The committee gathered from these specifications what it thought was the best practice, and inserted in the report a recommendation of what we consider good practice. Now, if you do not want to follow that practice, cut it all out; if any road does not desire to use the lap siding it can use shingles, or vertical siding, or any class of siding it desires; it can use lap siding on one-half and shingles on the other half, or it can use lap siding entirely, or vertical siding entirely. We simply make this as a recommendation of what we consider a building of good design, one on which slate or asbestos shingles are to be used. We eliminated the ordinary wooden shingle, because we did not consider it a safe roof from the fire standpoint. If you do not want these things, send the report back to the committee; but in sending the report back to the committee I think the convention should tell the committee what it wants, and not let the committee come in year after year with recommendations and have them stricken out. (Applause.) I wish to state that this is my maiden effort. (Applause.)

W. L. Webb (Con. Eng.): There is one principle involved in this question, which applies to the whole subject matter that is to go into the Manual. I do not think we should permit anything to go into the Manual except the essentials of practice, and when some little detail is brought up which can be done in half a dozen different ways, all equally good, or at least some applying in one place and some in another, I do not think that some one method of doing that thing should be put into the Manual. This has already been brought to my attention in many cases. A great many things have been put into the Manual which engineers of roads will not agree to, they will not recommend them to their roads, and even if they do recommend these things, those higher in authority will not agree to them. Whenever we allow anything to go into the Manual which will not have general acceptance, it weakens the Manual to that extent.

Mr. Loweth: Mr. Webb has expressed my sentiments much better than I have been able to do for two or three years, and I am glad he spoke as he did. I asked last year, I think, why, when there are several ways of accomplishing a result, all equally good, should we select one of these several methods and put it into our Manual? Now, the inference is very clear that whatever is not recommended is passed over because it is not as good as something else. One of the speakers has said that if the railway companies in their wisdom decide not to follow the recommended practice they are at liberty to do so. I think it would have been better for the speaker to have said if some of the railway companies in their presumption decline to follow the recommended practice they are free to do so. I feel that when a body of men such as those composing the membership of this association deliberately pass on these details and put them into the Manual for Recommended Practice, I should have to have very many and excellent reasons for not putting them into practice in my own work, and I stand ready, so far as I can, to put into my own practice everything that is approved by this convention, but I do not want to be hindered with the non-essentials.

Mr. Chamberlain: I want to say, in regard to what Mr. Webb and Mr. Loweth have stated, that I do not consider by any means that the action taken by this convention in striking out the two paragraphs has destroyed these recommendations. The essentials of these little houses are the general size, the size of the doors and the shape of the houses. If the convention sees fit to adopt the recommendations, omitting these two, we can build a house from these little diagrams, if we want to build it that way, and if you do not want to cover it with drop siding you can cover it with shingles or asbestos or corrugated iron, or something else. The same applies to the roof; we can put on shingles, slate roof, some ready-made roofing material, or tin. So I personally do not feel that the striking out of these two clauses really damages the recommendations we have made; it simply puts it up to the engineer who builds a house, if he follows this design, to build it of any material he sees fit. I move that the entire recommendation in regard to section tool houses be adopted and incorporated in the Manual as amended; that is, striking out these two paragraphs under Class A, and, of course, under Classes B and C, as the only difference between the buildings as recommended is the matter of size. I make this motion simply to get the matter before the convention.

Moses Burpee (Bang. & Aroos.): I ask if it is the intention to place in the recommended practice that tool house which is shown, with no glass in the windows or doors.

Mr. Chamberlain: It was the intention of the committee that there should be no glass, only shutters. My experience is that the glass in section houses is in very poor condition, and that simply openings for sliding shutters are preferable. There is another objection to the closed house in addition to this, and that is that the section men instead of being out on the section will stay in the section house in the winter and play cards.

Mr. Burpee: My opinion is that glass in the tool house is very well taken care of if we consider it necessary. My road is in a colder climate than most roads.

E. F. Wendt (P. & L. E.): This is a new subject, which has been considered during the past year. I think it was not considered previous to that time. The general purpose of the instruction was to get a conclusion respecting the general layout of tool houses. These small houses are necessary on every road, and it was thought wise to get some conclusion respecting size and general layout. It does seem to me, in view of the discussion this morning, that the convention would make greater progress if the conclusions this year were limited to the first portion of the recommendation, that relating to the layout, which involves the size. The detail specifications may be considered later. Furthermore, tool houses are built for special purposes and the design will need to be amended to show some interior equipment, so that the houses may be of the maximum use. I, therefor, would ask if the committee would agree to a conclusion, which will be limited to the diagrams and the first paragraph under Classes A, B and C, respectively, giving layout and dimensions of each, but leaving the subject of detail specifications to a future meeting.

Mr. Chamberlain: That is what I wanted to get at. If Mr. Wendt wishes to put that in the shape of a motion I will withdraw my motion.

Mr. Wendt put his suggestions in the form of a motion.

The President: It would be understood that conclusion 4, on page 173, would remain as it is, as it refers simply to design.

Mr. Fritch: We have attacked everything about the poor, little section tool house except its location. I think the location is an important point, and it should be beyond the switches. There is a lot of time lost by section forces being hemmed in by trains lying within side tracks and within switches. I suggest a clause be added: "The location of tool houses should preferably be beyond the switches."

The President: Does the motion include the diagrams?

Mr. Wendt: The motion includes the diagrams when they are corrected by the committee.

Mr. Loweth: I amend that by omitting the diagrams. My reasons are: First, that the text contains all the information that is necessary; and, second, that these diagrams show roofs projecting a considerable distance. We want to design the section house or the tool house so that, in some respects at least, it will harmonize with the appearance of the station, and it may be that that projection of the roof will be quite out of harmony.

Mr. Chamberlain: This is simply a diagram, not an architectural design for a building, and there are some things shown in the diagram which it is pretty hard to explain in the text. I do not think there is a particle of objection to incorporating the diagrams, as such, in the Manual. We understand that anyone who wishes to build a tool house to conform with some station nearby is at perfect liberty to do it. The diagrams show as little as they can—they are outline sketches. They show the distance of building from track, which is important, and size of doors, and location of track leading into the houses, which is important. I would prefer to see the resolution adopted as Mr. Wendt presented it.

Mr. Stein: I think we will all agree that with a little more discussion we will have absolutely nothing left here. I am not so certain that the dimensions given in these diagrams and in the text are just what we want. I would amend the original motion, therefore, and refer this entire matter back to the committee for another year's consideration.

Mr. Chamberlain: The subcommittee spent a good deal of time on this. It looks like a little thing, but it is discouraging to bring these things before the convention and have members get up and object and offer nothing in place of what they object to. It is perfectly feasible and perfectly rational to alter these recommendations later on, even though they should be adopted. I am speaking particularly for the subcommittee, which has labored assiduously and faithfully to try to give you something. Unless you have some specific objections to these diagrams going in the Manual, I think Mr. Wendt's original motion is perfectly proper.

Mr. Snow: Class B is given as 16 ft. over all, with a sliding door on the inside, 8 ft. in the clear. That is a practical impossibility.

C. Dougherty (C. N. O. & T. P.): In regard to the diagram, I would object to the location of the house 8 ft. from the nearest track. I do not think that is enough.

Hunter McDonald (N. C. & St. L.): Possibly the board of direction made a mistake in referring this subject to a committee at all. Certainly we ought to tell the committee just what we want them to report on. We seem to have left it to their discretion to a large extent. I do not think it wise to reverse and amend the reports of committees, I think we have had enough discussion here to enable them to revise the report, and I think it should be referred back to the committee for further consideration.

A vote was taken on Mr. Loweth's amendment, which was lost.

Mr. Wendt's motion was carried.

ROADWAY*

The subjects assigned were as follows:

(1) Consider revision of Manual; if no changes are recommended, make statement accordingly.

(2) Collect all known formulas for determination of size of waterways, and tabulate them in such manner that they may be intelligently compared. Also consider whether, by the introduction of factors suiting local conditions, a general formula for waterway areas could not be used in all cases.

(3) Confer with Committee II, on Ballast, and report relative to unit pressures allowable on the roadbed of different materials.

(4) Report on the following: (a) Tunnel Cross-Sections; (b) Tunnel Lining; (c) Tunnel Drainage and Ventilation.

(5) Investigate and report on the question of agricultural drainage in levee and marsh district as they affect railways: (a) Laws and assessments; (b) Methods of construction of drainage channels through railways.

Sub-committees were appointed as follows:

Sub-Committee A—Consider Revision of Manual: S. B. Fisher, Chairman; H. J. Slifer, J. G. Sullivan, A. M. Kinsman.

Sub-Committee B—Tabulate Formulas for Waterways: W. D. Pence, Chairman; John C. Beye, J. A. Spielmann.

Sub-Committee C—Mean Pressures Allowable on Roadbed: W. M. Dawley, Chairman; Duncan MacPherson, John C. Sesser, Paul Didier.

Sub-Committee D—Tunnels: J. E. Willoughby, Chairman; D. J. Brumley, Walt Dennis, Curtis Dougherty.

Sub-Committee E—Agricultural Drainage Districts: W. C. Curd, Chairman; Moses Burpee, R. C. Young.

*From a report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

The committee reports progress on subjects (2), (3) and (5), and suggests that these subjects be reassigned.

Conclusions.

(1) Your committee recommends that the changes given under the heading of Revision of Manual be approved.

(2) It is recommended that the conclusions given under the heading of Tunnels be approved and incorporated in the Manual of Recommended Practice.

The report is signed by: George H. Bremner (C., B. & Q.), chairman; S. B. Fisher (M., K. & T.), vice-chairman; John C. Beye (C., R. I. & P.), D. J. Brumley (Ill. Cent.), Moses Burpee (Bang. & Aroost.), W. C. Curd (Mo. Pac.), W. M. Dawley (Erie), Walt Dennis (K. C. S.), Paul Didier (B. & O.), C. Dougherty (C., N. O. & T. P.), A. M. Kinsman (B. & O.), Duncan MacPherson (National Transcontinental), W. D. Pence (Univ. of Wis.), John C. Sesser (G. Nor.), H. J. Slifer (C. G. W.), J. A. Spielmann (B. & O.), J. G. Sullivan (Can. Pac.), J. E. Willoughby (L. & N.) and R. C. Young (Lake Superior & Ishpeming).

Appendix A.

Revision of Manual.

The sub-committee recommended the following changes in the definitions:

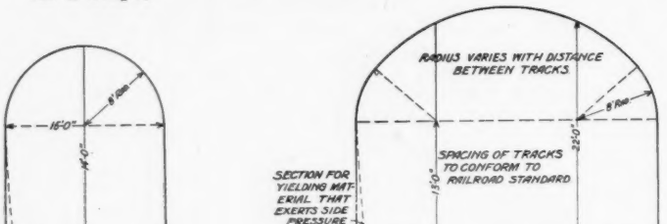
Slide.—The movement of a part of the earth under the force of gravity.

Washout.—The carrying off of the permanent way by the impact and erosion of flood waters.

Bog.—Soft spongy ground, usually wet and composed of more or less vegetable matter.

Berme.—(a) The space left between the top or toe of slope and excavation made for ditches or borrow pits.

Berme.—(b) An approximately horizontal space introduced in a slope.



Tunnel Clearances.

The committee submits for approval the following definition:

Earthwork.—The moving of masses of earth by artificial means.

The committee recommends that the recommendations under Specifications for the Construction of the Roadway be revised as follows:

That paragraph 4 be amended to read: "Profiles should be made complete in regard to distribution of material."

That paragraph 1, under the heading Design and Construction of Roadway, be amended to read: "There should be recognized three widths of roadbed for standard-gage railways, and these should be selected to suit the density of traffic. These widths should be 14, 16 and 20 ft."

That the Specifications for the Formation of the Roadway be amended as follows:

That paragraph 11 be amended to read: "In localities where isolated trees and buildings exist, payment shall be made for their removal at a price to be agreed upon."

That paragraph 37 be amended to read: "In crossing bogs or swamps of unsound bottom, for light fills a special substructure of logs and brushwood may be required, the logs forming this foundation to be not less than six (6) in. in diameter at the small end. If necessary there shall be two or more layers crossing each other at right angles, the logs of each layer being placed close together, with broken joints, and covered closely with brush; the bottom layer shall be placed transversely to the roadway and project at least five (5) ft. beyond the slope stakes of the embankment."

That paragraph 72 be omitted.

That the following clause be added to the recommendations under slides, adopted in 1909:

(7) The weighting of the toe of the slopes to restore equilibrium may sometimes be found efficient.

That former (7) be renumbered (8); former (8) be renumbered (9).

Appendix B.

TUNNELS.

The committee has undertaken to consider the tunnel only in so far as to make recommendations covering the following matters:

(a) Form and dimensions of the clear opening to be provided for trains, both on straight and curved track;

(b) What change is advisable, if any, in the rate of grade through the tunnel where the tunnel occurs on a ruling grade;

(c) The character of masonry advisable to adopt for the permanent lining where the tunnel is excavated through material requiring support;

(d) The system of drainage best adapted to the tunnels.

The committee issued on August 6 a request for blueprints typical of present practice and for replies to the following questions:

1. What modifications do you make in the dimension of the clear opening to accommodate curved track?

2. Do you prefer stone, brick or concrete (or combinations of any two) for lined tunnels through:

(a) Thin strata of hard stone?

(b) Slate or like material good for one to three months without support?

(c) Shales, clays, etc., swelling on exposure?

(d) Mixed boulders and clay when dry? When wet?

(e) Unsound material of any kind requiring support of roof and sides only?

(f) Unsound material of any kind requiring support for roof, sides and bottom?

3. Do you use any formulas for determining the thickness of masonry in linings?

4. Do you reduce rate of maximum grade through tunnels? At what rate?

5. Do you have any tunnels where drainage is carried through conduits or pipe lines? Where are the conduits and pipes located? What precautions are taken to prevent them from filling? Is such drainage efficient?

6. Do open side ditches give efficient drainage? Have you taken precautions to make the ditches smooth with concrete to facilitate shoveling out the accumulation in the ditch?

7. Would you prefer the drainage of a single-track tunnel be concentrated in one ditch, conduit or pipe, or distributed in two?

As a result of its deliberations and the examination of a multitude of plans sent to it, the committee submits the following partial report:

It recommends the adoption, for single track tunnels on tangent, of a tunnel section 22 ft. high from top of rail to soffit of arch over the center of track, and 16 ft. wide between sidewalls. Where pressure against the sidewalls must be provided for, it will be advisable to reduce the width at rail top level to 14 ft. and to join the springing line width of 16 ft. and rail top width of 14 ft. with a curve of long radius.

When a tunnel is on curved track, the section should be widened and the track displaced from the center of tunnel to such an extent as to give substantially the same clearance at the car floor level and at the car-eave level as is given on tangent by the dimensions recommended above.

For double-track tunnels it is recommended that the width to be that suggested for single-track tunnel plus standard width between track, and that the clear height above top of rail over the center of each track be 22 ft.

The arch for a single-track tunnel should usually be a semi-circle. The arch for a double-track tunnel should have the central portion constructed on a long radius and with short radii to connect the central portion to the sidewalls.

The dimensions given are considered the minimum for Class A track. The size of the tunnel should not be varied for the different classes of track on account of the high cost of enlarging a tunnel constructed to a less dimension than that required for Class A track, and in view of the probability of all principal lines of railway soon needing roadways to support Class A track.

The committee is not satisfied with the prevailing drainage in single-track tunnels through side ditches and favor some form of pipe drainage, but cannot make recommendation at this time as to what construction is best. The advice of the full committee is requested.

For double-track tunnels the committee favors carrying the drainage down the space between the two tracks through a concrete channel, which may be covered with old boiler plate if so desired.

It is recommended that the rate of grade in long tunnels be lessened by 25 per cent. from that of the ruling

grade so as to compensate for the greater resistance due to bad track, the less adhesion due to wet rail and to avoid the possibility of the train stalling in the tunnel, with the resulting asphyxiation of the train crew.

Concrete is recommended for the permanent lining of tunnels requiring support. It is recognized, however, that in certain conditions, e. g., when the movement of the material through which the tunnel is excavated is so rapid that concrete will not have time to reach a permanent set, a brick lining must be constructed. When brick are used for tunnel lining that portion of the arch for a horizontal distance of five feet each side of the center line of track should be of vitrified brick laid in Portland cement mortar.

Conclusions.

The following is submitted for insertion in the Manual of Recommended Practice:

1. That the form and dimensions of the clear space to be provided for single and for double-track tunnels on tangent conform to the accompanying diagrams.
2. For tunnels on curved track, the dimensions of the section should be increased and the track displaced from center of tunnel so as to give substantially the same clearance as is given on tangent by the sections above.
3. For double-track tunnels the drainage should be provided for by the construction of a concrete channel midway between the tracks.
4. The rate of grade in long tunnels should be reduced so as to be 25 per cent. less than that of the ruling grade.
5. Concrete should be used for the permanent tunnel lining except where local conditions will injure the concrete before there is time for it to harden.

In the event that a brick lining be used, that portion of the arch for a horizontal distance of five feet on each side of the center line of each track should be laid with vitrified brick in rich Portland cement mortar.

Discussion on Roadway.

G. H. Bremner (C. B. & Q.): The committee would like to eliminate the definition for earthwork. In regard to profiles, we make it read: "Profiles should be made complete in regard to distribution of material," and cut out the reasons for making it complete in that conclusion. Under "Design and Construction of Roadway" we strike out the words "probable density" and "to be handled in the future." In the provision for carrying small articles off of the right-of-way, the word "grading" is substituted for "clearing." In regard to crossing bogs or swamps the words "for light fills" were put in. Paragraph 72 was cut out from the specifications. Those are all the changes in the Manual except the change which we were instructed to make last year in regard to washouts.

Conclusions 1 and 2 were approved.

Mr. Bremner: This report on tunnels does not cover the full instructions of the board of direction in the consideration of this matter. We hope to go into the matter further and report other conclusions and recommendations during the coming year.

Mr. Bremner then read conclusions 1, 2, 3, 4 and 5, with regard to tunnels, and moved their adoption.

G. A. Mountain (Can. Ry. Com.): I notice the diagram for double-track calls for 22 ft. clearance head room from sub-grade. Day before yesterday, on bridges, this house approved 22 ft. from top of rail.

Mr. Bremner: The diagram was intended to show 22 ft. from top of rail.

The President: That amendment will be made.

R. N. Begien (B. & O.): I move to amend conclusion 4, to read: "The rate of grade in long tunnels should, if necessary, be reduced tby an amount equal to 25 per cent. of the ruling grade." We can readily conceive of cases where the tunnel is on other grades than the ruling grade. I believe ruling grade has never been defined by this convention.

G. D. Brooke (B. & O.): In connection with some location work on the Baltimore & Ohio, with which I was connected some years ago, we considered this matter of reducing grades in tunnels. At first we reduced the grades through the tunnels themselves. Later, we considered it would be better to reduce the grade below the tunnel. Th purpose of the reduction of th grade in the tunnel is to relieve the engine of the extra work due to the slipping of the wheels in the tunnel, and also on account of the gaseous conditions of the tunnel. If the grade is held to the maximum, practically all of the train will be on the heavy grade when the locomotive enters the tunnel, and the speed of the train will be reduced; but if the grade is reduced below the tunnel the train will be accelerated and on entering the tunnel will have higher speed than on maximum grade. This will be reduced as it goes through the tunnel and it should emerge from the tunnel at about the maintained speed.

Mr. Mountain: I want to enter an objection to the method of measuring this head room from the top of rail. I think that is wrong. The top of rail is not a fixed point. In my practice on the Canadian Railway Commission we order it from the base of rail.

J. E. Willoughby (L. & N.): The committee considered that there should be a greater reduction of grade on those grades that require helper service than on the lighter grades, and that was one reason the committee adopted the ruling grade. The usual measurement on American railways for clearances has been from the top of rail, since that is the clearance that the train will need. Now it is assumed that the road will be maintained in the tunnel, so that the clearance above top of rail will not be diminished. As to the reduction of the rate of grade before you get into the tunnel, the engine is supposed to carry its rating up the grade outside. I think the only place where the reduction of grade is necessary is in the tunnel.

C. S. Churchill (N. & W.): I think that the committee is working on the right lines in reducing the grades of tunnels, but it does not seem to me that they have given all the reasons for it. The important reason, in my opinion, is that the grade be reduced in the tunnel, and at the end of it, in order to reduce the work of the engine while passing through the tunnel, when that tunnel is on a ruling grade. Unless that is done, it is only a question of time when artificial ventilation must be resorted to in case the tunnel is of considerable length, say, over 2,500 ft. That has been thoroughly tested out. It is a matter of record. I believe the committee is right in its recommendation to reduce at least 25 per cent. for those reasons, and that that reduction should extend below the entrance of the tunnel a short distance. I think that should be borne in mind in view of other questions this committee has before it. The question of ventilation will come up later; they say they have not acted on at present. It is very important that the ease of trains passing through tunnels be greater than on the line below the tunnel, where the tunnel is on ruling grade.

Mr. Bremner: The intention of the committee was to fix the grades so the trains could get through the tunnels easier and quicker. In fixing 25 per cent. reduction of grade the engineer should certainly take into account the approach grade. If the approach grade is light, the reduction of the grade in the tunnel should not be so great. If the approach grade is steep, it should be reduced to meet the grade in the tunnel and the amount of reduction in the tunnel would depend to a great extent on the approach grade, and it is the ruling grade over the division that governs the length of the train. So it seems to me we have covered that matter in saying that the grade in the tunnel should be reduced 25 per cent.

Mr. Churchill: I think it should be at least 25 per cent., and I think it would better be expressed that way. The French engineers recently passed on this question and made it a specification that the grades in tunnels should be reduced, and that it is necessary for ventilation purposes. We have one on our read 3000 feet long, and it is reduced 60 per cent; yet ventilation has been necessary for years.

Mr. Courtenay: It is our experience that it is very desirable to reduce grades in long tunnels for a variety of reasons. Long tunnels in a mountainous country are very apt to be near the summit on long grades; frequently the track is wet in those tunnels. The adhesion of the locomotive drivers on the rails is less. It frequently happens that quite serious consequences have been due to stalling in these tunnels, where the precaution was not taken in the original construction to materially reduce grades, and I presume those who have long tunnels have sometimes had to carry their enginemen and firemen out of the tunnel unconscious. This, so far as my experience goes, has been partly due to having summits in tunnels. I do not find that the committee has covered that point, and I would suggest that if, under the instructions, it be proper, it should express a recommendation prohibiting summits in tunnels. There is only one valid reason that I know of for putting a summit in a tunnel, and that reason I do not consider good. Sometimes great quantities of water are met in long tunnels and apparently the reason for some summits in tunnels is on account of the engineer

providing against water, so at ⅞ or ¾ of the length of the tunnel down hill he puts in the summit. The effect of the summit is largely to interfere with the draught through the tunnel and to collect smoke and hold it. My experience is that much shorter tunnels, with summits in them, are far worse for the trainmen than longer tunnels with approximately the same height of cross section without the summits, if practicable, without too great cost. I agree with the opinion expressed here that the grade should be reduced before reaching the tunnel. In most long tunnels it is a very serious question to cut down the length of the tunnel.

Mr. Wendt: This discussion is most interesting and profitable, but I doubt if we will come to any final conclusion on a question of this character without having the Committee on Roadway and the Committee on Economics of Railway Location come together in conference and agree on a conclusion. There are four main questions before us this morning. The first, tunnel cross-section; second, tunnel lining; third, tunnel drainage; fourth, tunnel ventilation. I suggest that these questions be taken up one by one, and that the question involved in conclusion 4 be referred back to the committee for further consideration during next year.

J. A. Lahmer (K. C. S.): There is another reason for considering the grade before entering into the tunnel, instead of considering the reduction of the grade in the tunnel, which I don't believe I have heard expressed. In some cases the biggest part of the train may be still outside of the tunnel when the engine is working in the tunnel. This, of course, would be applicable in the case of long freight trains. The engine would be obliged to work throughout the tunnel on account of the train being largely on the grade approaching the tunnel.

Mr. Bremner: The committee is willing to make conclusion 4 apply also to approaches. In regard to the summit of grade in a tunnel, the committee expects to consider the subject of ventilation next year.

H. G. Kelley (Grand Trunk): Returning to conclusion 1, Mr. Mountain brought up the question as to the point from which clearance should be measured. The original Railway Act in Canada was intended to give a 22-ft. clearance for an ordinary box-car and a man on top, but the commission said, "Rails are changing in height, maybe an inch or maybe two inches, and we will give 22 ft. 6 in. from the base of rail." Suppose we are running with a 4¼-inch rail and we build our tunnels and bridges and we give 22 feet above the top of that rail. Next year we put down a 6-in. rail. All of our structures violate the Act. It is only an inch or two, to be sure, but an inch or two will win or lose a damage suit. I agree heartily with Mr. Mountain in this matter, that we should give the clearance from a fixed point, and that is the base of the rail. You put up a structure with your horizontal and vertical clearance fixed from a definite point, the horizontal from the center of the track, and the vertical from the base of the rail. You can change your rail, but you cannot change the vertical clearance on a bridge or on a tunnel without taking it down. The same thing will occur in this country. The time will come in the United States when the fixed clearances will be enforced just as safety appliances are enforced, and I think this association should leave nothing indefinite in these conclusions and recommendations.

Mr. Lahmer: If you fix the clearance from the base of the rail, when, say, you have 4¼-in. rail, and later use 6-in. rail, then you have to reduce the actual clearance, which is from the top of the rail.

Mr. Kelley: The gentlemen misses the point I am trying to make. I know the clearance will be reduced a little, but the effect is not the same. We are working under a law and when the clearance is given from the base of the rail we cannot raise our rail, but we can raise the top of the rail to meet the requirements and still comply with the law. You gentlemen who do not work under a precise act do not appreciate that, but in Canada we are working under a precise act, precise laws and precise figures, and any violation renders their companies liable for negligence.

Mr. Lahmer: I appreciate the point you are trying to make. I simply wanted to point out that we would not be saving our clearance.

Mr. Courtenay: In at least one state the statute requires a clearance to be from the top of the rail. I think it would be futile to try to conform to the statutes of the states and to the laws of Canada.

Mr. Mountain: If you meet with an accident and they find out your tunnel has been reduced you will be out of court.

A. S. Baldwin (I. C.): As a matter of fact, this dimension is really more fixed than if it were a dimension from base of rail. It behooves a road to make the depth below the base of rail under this diagram such that it will not go outside of the law. It is absolutely more fixed here than it would be by dimensioning it from the base of the rail and allowing six inches, as is the custom in Canada. Suppose later a 10-in. rail should be adopted, there is nothing in the Act of Canada that would prohibit that. You can have it 22 ft. 6 in. to the base of the rail and take in a 10-in. rail and you will not have the clearance and you will be conforming with the statute. But if you have absolute dimensions to the top of the rail, it is impossible for railways to use a rail higher than the one originally designed without going outside of the statute. I think this diagram is proper, and that it is incumbent on the railway in designing the tunnel to make sufficient provision to insure that it does not go outside of the diagram and infringe the law.

J. G. Sullivan (C. P.): I don't like to make an international question of this, but I do wish, however, to support Mr. Mountain in this contention. This liberal interpretation of the Canadian Railway Act was made at the solicitation of the railway engineers of Canada. If, as has been said by Mr. Kelley, we put in a 6-in. rail where we had a 4-in. and the clearance was 22 ft. 6 in. above the top of the rail, at that time we would be out of court in a case at law. Supposing we do put in a 10-in. rail, the laws are strict enough to tie the railways down tight enough, and with all the laws that we have adverse to railway construction and railway operation, I don't think that this body should try to advocate the principle of tying them down tighter and make it impossible to do practical things. It is only natural to expect that we will probably increase the height of our rail, probably another inch, within the lifetime of some of the members here, but it is not probable that we will go to 10-in.

Mr. McDonald: I believe the committee would consent to have the words "unless otherwise required by law" added to conclusion 1.

Mr. Bremner: I think that is understood with all our conclusions as a matter of course.

Mr. Kelley: Mr. Baldwin says taht we should provide for lowering our base of rail, if required by use of heavier rail. We are discussing the clearance of tunnel; that means taking out some ballast. That we can do, but the clearance that we fix for tunnels will be the clearance that we fix for bridges or any other overhead structure. We cannot lower the floor of our bridges without undue expense. In many cases we cannot lower it at all. It does seem to me the base of the rail is a fixed point. We can always control the base of rail feature, but we cannot always control the top.

C. H. Ewing (P. & R.): There is another matter that has not yet been touched upon, and I doubt very much the wisdom of this association providing clearance such as is proposed in admitting the necessity for providing clearances such as proposed in admitting the necessity for providing clearances for a brakeman on the top of a car. The question of clearances has been disposed of by the Safety Appliance Act. The introduction of air brakes makes it unnecessary to provide such clearances as are here proposed. It is absolutely impossible in cities to provide such clearances for overhead bridges, and I doubt very much the wisdom of the association in admitting the necessity for providing clearance as great as this.

Mr. Willoughby: The object of the committee in suggesting 22 ft. covered the necessity of providing space enough to prevent unpleasant results to passengers from smoke while passing through tunnels, and, in long tunnels, avoiding the asphyxiation of the engine men. It included a little more than the clearance of bridges, where such conditions would not obtain. The first fixed point in railway construction is the sub-grade. Railways having a legal stipulation relative to the clearance height above base of rail would take that into consideration in fixing their sub-grades. I think, therefore, the stipulation of a certain definite distance above the top of rail, covering, as it does, the comfort of the passengers and enginemen, is of more importance than making an exception for a specific law in one part of the country.

Mr. Baldwin: Mr. Kelly misunderstood my reference to lowering the grade. I meant to convey the idea that should be considered in the design of a structure. It would behoove a railway company, I think, in designing its structures to provide a sufficient clearance to take care of any rail that is likely to be used.

Mr. Fritch: The matter of clearances not only affects our tunnels, it affects our bridges, and later on it is going to affect electrification. In electrification you need all the clearance you can get. It is strange that we did not discuss this more thoroughly when we had up the question of the clear-

ances on iron and steel structures. That diagram refers to clearances from top of rail. Personally I think the base of rail is the point that we ought to adopt in all our clearances, because if railroads are going into electrification—and they are in the future—we must have a point that will not vary, and the base of the rail and the top of the tie will not vary.

Mr. Burpee: As to ballast, I think the recommendation does not mean to tie anybody down to this as a maximum, but rather as a minimum, and I don't believe there is an engineer in the room who would not make some allowance for the difference in the height of rail to be used in the future. I think he would make a difference of an inch to provide for a larger rail to be used in the future, and I think it would be wise that an allowance should be made for possibly a few inches of raise in ballast under the tie, and that any engineer in adopting a design for a tunnel would be sure to make these allowances.

Mr. Sullivan: I am sorry I am against the government, again, but I want to know how many engineers in this room use the top of the rail at the datum for their bridge foundations, and so forth.

Mr. Bremner: If they follow the conclusions and the directions of this association, they all use the top of the rail. On page 257 of the Manual, general specifications for steel railway bridge designs, it says: "On a straight line, the clear height of bridges shall not be less than 21 ft. above top of rails for a width of 6 ft. over a single track," etc.

Mr. Sullivan: I was referring to the foundations.

Mr. Bremner: You will have to tie the two together. I don't see how they can be separated. The association is already committed to the top of the rail as a basis for clearance vertically. If we change it, as to tunnels, to the base of the rail, we should do the same for bridges and our other work.

Mr. Baldwin: I move that the clearance height as indicated on this diagram be changed so as to be the dimension from the base of the rail, and that this height be given as 22 ft. 6 in. instead of 22 ft.

Mr. Mountain: The base of rail has no fixed relation to the top of the tunnel. One of the most difficult orders to enforce is to keep the track men working in tunnels where they have bad air most of the time.

Mr. Baldwin's amendment was adopted.

Mr. Lindsay: I move to amend Mr. Begien's motion as to conclusion 4 by referring that conclusion back to the committee with instructions to confer with the Committee on Economics of Railway Location and the Committee on Roadway. It should also be considered in connection with ventilation.

Mr. Lahmer: I second the amendment.

Mr. Willoughby: The committee took up the question of the reduction of the grade in long tunnels, because it had to solve the question of ventilation in tunnels. The committee has in mind that the association has already expressed its belief that 0.2 per cent. grade is the minimum for drainage in pipes. The committee feels that it has not gone beyond the direction of the board, but has simply taken up another subject so as to enable it to properly carry out the direction of the board.

Mr. Lindsay's amendment was carried.

Mr. Bremner: As to the other work which the board of direction gave us to do, "Collect all known formulas for determination of size of waterways, and tabulate them in such manner that they may be intelligently compared," there has been a lot of work done on that by the subcommittee under Prof. Pence, and it expects to give you a report later on it. We hope to get a conference with the committee as to unit pressure allowable on roadbeds. With reference to agricultural drainage, Mr. Burbee has obtained the laws of nearly all of the states, and we will make a synopsis of that, which he will present to the convention this summer, probably.

Mr. Fritch: I would like, if it would not be inconsistent, to refer to the Iron and Steel Structures Committee report, and change the recommendation with reference to the clearance diagram to conform to the action taken by the Roadway Committee on the matter of clearance in tunnels.

The President: We will do that.

RECORDS AND ACCOUNTS.*

The committee was assigned the following:

1. Revision of Manual.
2. Recommend a system for numbering all forms adopted.
3. Continue recommendations of changes in adopted conventional symbols, with especial reference to Forms M. W. 1020 and 1022.
4. Recommend forms for preparing preliminary detailed estimates of contemplated construction, this form to be used preliminary to and form the basis for the summary estimate data embodied on Form M. W. 1017.

The organization for sub-committee work was as follows:

A—Revision of Manual: M. C. Byers, chairman; C. W. Pifer, Thomas Maney.

B—Conventional Signs: A. L. Davis, chairman; W. H. Sellew, J. H. Milburn, V. D. Simar.

C—Bridge Estimates Forms: Edward Gray, chairman; R. W. Willis, E. E. Hanna.

D—Building Estimate Forms: T. H. Gatlin, chairman; W. P. Wiltsee, S. D. Brady, Paul Jones.

E—Water Service Estimate Forms: C. H. Gerber, chairman; O. L. Holman, J. M. Brown.

F—Accounts: Henry Lehn, chairman; J. E. Turk, G. L. Moore.

Revision of Manual.

In answer to a circular there were 38 replies, of which 22 said that none of the forms that have been recommended by the association were in use on the railways represented, and 16 replied that some of the forms were in use. However, 5 of the 22 reported using a few that were very similar in character.

The great difficulty that confronts the study and consideration of forms is the variety of organization on existing railways. It is this difficulty that has made it impossible for the committee to conclude fully its study with reference to the revision of the Manual.

H. R. SAFFORD,
Chairman Committee on Records and Accounts.

The definitions on page 173 of the Manual, as well as the recommendations in regard to filing of duplicate records, are approved.

The sub-committee reported that it was not practicable to either approve or disapprove certain blanks intended for use by the bridge and building departments until a definite form of organization is adopted. A discussion of this matter brings up the question of the advisability of considering in the work of this committee the subject of organization, and the committee would like instructions from the board of direction, as well as an expression from the membership of the association of the advisability of attempting to create forms that will apply to the various types of organization.

Form M. W. 1000 seems to be unnecessary, as it only tells the whereabouts of the bridge gang, and this could just as well be accomplished by the use of a small card or a brief note from the foreman to his superior. The work of a bridge foreman is carefully planned, and the superior officer always knows where his forces are located.

It is the opinion of the sub-committee that Forms M. W. 1003, 1005, 1006, 1007 and 1009, which are reports of the use of tools, material and inspection of structures, are not required in the ordinary organization.

Form M. W. 1011, Register of Title Deeds, is approved.

As to Form M. W. 1012, Contract and Lease Records, the

*From a report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

committee considers it advisable, under certain conditions, to use a card index, and therefore suggests that under the specification on page 213 the word "book" be eliminated, which will make the specification elastic enough to embody the use of a card index where desired.

Conclusions.

(1) To recommend to the board of direction that the committee be authorized to submit different forms, if necessary, calling for the same information to suit varying organizations.

(2) To abolish Form M. W. 1000.

(3) To further consider Forms M. W. 1003, 1005, 1006, 1007 and 1009.

(4) To indicate on Form M. W. 1010—

(a) Data showing width of streets and alleys.

(b) Distance along street lines which intersect the right-of-way line.

(c) A line representing the original center line of the main track.

This should also be ambodied in the definition of right-of-way map as it appears on page 667, Vol. 9, of the proceedings, definition No. 1.

Conventional Signs.

There are three groups of conventional signs, Forms M. W. 1020, M. W. 1021 and M. W. 1022. Form M. W. 1021 has been revised and accepted by the association, and the symbols apply more particularly to track maps. Forms M. W. 1020 and M. W. 1022 are applicable, the former more particularly, to right-of-way maps and maps showing preliminary and location surveys, the latter to structural and roadway designs.

The committee has combined Forms 1020 and 1021, making a number of changes and additions and a better grouping. It has similarly revised Form 1022.

In starting its work, the committee sent out a circular, asking, among other questions, to what extent the present forms were in use. To this circular 50 replies were received, showing:

Number using symbols on forms 1020 and 1022.....10..20 per cent.
Number using symbols to a large extent....17..30 per cent.
Number proposing to adopt forms 1020 and 1022..... 4..8 per cent.
Number not using these forms.....19..38 per cent.

Conclusions.

The conclusions of the committee as a whole, with reference to the work of the sub-committee, are as follows:

(1) The use of red ink with black arrows for dimension lines on all drawings.

(2) Combination of Forms M. W. 1020 and 1021, as illustrated on the attached chart.

(3) Revision of Form M. W. 1022, as represented on revised Form 1022.

(4) Use of the following titles for forms covering drafting practice:

(a) For conventional signs on pp. 132 to 138, inclusive, 1907 Manual: "Conventional Signs for Use on Signal and Interlocking Plans."

(b) For Forms M. W. 1020 and 1021: "Conventional Signs for Use on Topographical and Right-of-Way Maps."

(c) For Form M. W. 1022: "Conventional Signs for Structural Drawings."

(d) For Form M. W. 1016: "Conventional Signs for Track Charts."

(e) For Form M. W. 1015: "Conventional Signs for Working Profiles."

(5) It is recommended that the signs composing the groups above indicated be published in pamphlet form and distributed to the membership of the association at a nominal price. Attention is called to the grouping of the conventional signs to enable the desired sign to be more easily found.

Bridge Estimate Forms.

The sub-committee received 45 replies to a circular, 39 of which indicated that the senders were in favor of the use of forms detailing the various items used in bridge construction. Only six replies were received which were not in favor of the use of such a form. Of the entire number only three or four roads had a form in use for the preparation of estimates of this character. Among these were the Chicago, Burlington & Quincy and the Chicago Great Western. A tentative form was submitted, fashioned, more or less, after the forms used by both of these roads.

After considerable discussion, it was the sense of the committee that further investigation ought to be made, as no decision was reached as to the extent to which such a form should show the detail items composing this estimate. One of the principal things to consider is for whose use these estimate forms are to be provided, and whether a form could be devised that would serve not only the man making ordinary wooden bridge estimates, but the bridge engineer who is called upon to make estimates of more extensive and complicated bridges. The committee has referred the subject back to the sub-committee for further investigation in next year's work.

Building Estimate Forms.

Much of the same difficulty was met in considering building estimate form as was met in the preparation of bridge estimate forms, and for the same reasons the committee has felt the necessity for further study of the subject. No report was submitted by the sub-committee.

Water Service Estimate Forms.

The sub-committee submitted a tentative form. As the same difficulties were met in considering estimate forms for water service work as were met in considering estimate forms for bridges and buildings, it was concluded by the committee that this subject be given further study by the sub-committee in next year's work, with the hope that the collection of additional data will enable a form to be developed.

Accounts.

The sub-committee made a short progress report.

Numbering of Forms.

It was necessary to agree on a definition for the term "Form," and the definition submitted by the committee is as follows:

Form.—A form is an outline or illustration of a prescribed method of indicating and recording information.

The committee submits a plan for numbering forms, which plan is considered to be sufficiently elastic to take care of the work of the various committees for many years to come. It groups the forms under 21 heads, to each of which are allotted 100 serial numbers, thus: Roadway, 100-199; Ballast, 200-299; etc.

In the indiscriminate use of the word "Estimate" it has a dual application, being used to indicate an approximate quantity, as well as to indicate the exact quantity of completed work, as the ordinary practice is to call a final statement of completed work a "Final Estimate." The committee recommends that the use of this term be applied only to such statements as are prepared for contemplated construction work, for statements prepared to show the progress of such work, and statements forming the basis for partial payments; and that the word "Statement" should be used for statements showing the actual work done.

The report is signed by: H. R. Safford (Ill. Cent.), chairman; H. J. Pfeifer (Term. R. R. Assoc. of St. Louis), vice-chairman; S. D. Brady (Little Kanawha), J. M. Brown (C., R. I. & P.), M. C. Byers (St. L. & S. F.), A. L. Davis (Ill. Cent.), T. H. Gatlin (Southern), C. H. Gerber (Un. Pac.), Edward Gray (Southern), E. E. Hanna (Mo. Pac.), O. L. Holman (G. Nor.), Paul Jones (Cin. & Mus. Val.), Henry Lehn (N. Y. C. & H. R.), Thomas Maney (L. & N.), J. H. Milburn (B. & O.), G. L. Moore (Lehigh Valley), A. G. Norton (Erie), C. W. Pifer (Ill. Cent.), W. H. Sellew (Mich. Cent.), V. D. Simar (Dul. S. S. & A.), J. E. Turk (P. & R.), R. W. Willis (C., B. & Q.) and W. P. Wiltsee (N. & W.).

Discussion on Records and Accounts.

H. R. Safford (I. C.): The committee has had its attention called to the sign for reinforced concrete and the use of the words "expanded metal" and "rods or bars." It had been suggested to us that the term "expanded metal" perhaps committed us to the use of one of several brands of material, and that it would better be expressed by the use of the word "metallic mesh," or something of that nature. I think the words "wire mesh" or "metallic mesh" would be better, and the committee suggests that change. I move that form 1022 or 1905 as revised in the new numbered system be adopted. The committee has worked with the other committee interested in the preparation of these signs, and we have attempted to meet their views.

Mr. Mann: I would like to ask the committee whether they consulted with the Committee on Signals and Interlocking. I notice in some cases the conventions used by this committee do not coincide with those used by con-

tractors and railways in purchasing signaling devices. For quite a long time the contractors and purchasers have been getting together on these functions.

Mr. Safford: The committee did confer with Committee 10 and the signs we present are in accordance with its views.

Mr. Fritch: The conventional signs under "rivetting" are not quite the same as the conventional signs recommended by the Iron and Steel Structures Committee. There is a distinction made in flattening the various rivets, as to size. For instance, flattening to ¼-in. refers to ½ and ⅝-in. rivets, and flattening to ⅜-in. has reference to ¾, ⅞ and 1-in. rivets. I want to ask if it will not be possible to increase the size there.

Mr. Safford: The intent of the committee was to show exactly the same conventional signs that were adopted by the Committee on Iron and Steel Structures. They may have made some modification of their signs after we had our conference with them. We will amend our form so as to agree fully with their signs.

Form 1022, or 1905 under the new system of numbering, was adopted.

A new work in reference to conventional signs was the consolidation of the two forms, 1020 and 1021. We added eight signs on page 106, one for streams, one for springs and sinks, one for lakes and ponds, one for falls and rapids, one for water line, one for marsh, one for canals, and one for ditches. The sign for the marsh, however, was brought over from 1022, as well as the one for ditches, in order to make a different indication from canals. We also add one for sand and one for cliffs. We have classified all the signs into various headings. They were not well classified before. On page 107 there are no material changes, except that we reduced the thickness of some of the lines merely to save time in drawing. On page 108 the committee this morning, acting upon a suggestion from one of the members, concluded to recommend the change for the signs for "new tracks" and "future tracks," near the bottom of the page. What the committee intended to do was to have one indication for tracks that were intended to be immediately constructed, to be used on construction maps, and another sign to show ultimate development. So it is suggested in place of the words "new tracks" and "future tracks," the words "proposed for immediate construction" will apply to the first and "proposed for ultimate development" will apply to the second. On page 109 we have added an indication for "battery box." We also propose to insert the words "Indicated length" between the symbol for turntable, and the word "turntable." On page 111 there has been a change with reference to the through pole wire lines. We had a similar indication for telegraph, but we thought it better to have a consolidated form to indicate all types of pole wire lines. That was discussed last year, and so it is not any change. A new indication appears for wire conduit separated from switch or signal lines. A change also appears on that page in the character of the form for dimension line. The committee concluded that red ink should be used for dimension purposes. We made a slight change in the character of distinction for the two meridian lines. I move that conclusion 2 be adopted.

Mr. Fritch: I do not think the committee missed many signs, but there is one omitted, which is quite important, and that is a telephone line, or a high tension transmission line, or any wire carrying electric current crossing the track. That is one, I think, which should be specified definitely. I do not know whether the committee intended that the designation under miscellaneous pole wire lines would cover that or not. It seems to me that would refer to telegraph lines.

Mr. Safford. The committee did have under consideration different indications for these different types of pole wire lines. We wanted to minimize the number as much as possible, and adopted an indication headed "pole wire lines," which can be supplemented by such explanatory wording as may be desired.

J. O. Osgood (C. of N. J.): We found it impracticable to use a number of the suggestions of the committee, not because they were not good, but because where there are such slight distinctions between lines they cannot be used on maps which are much complicated, so that for such matters as pole wire lines, and similar lines, we write on the map what they are. On page 108 there are three symbols used a great deal by all roads which do much construction work. I refer to those for new tracks and future tracks, in which you have changed the phraseology to advantage. The symbols are excellent, but we have found in practice that the expense of coloring a large number of blue prints is so great that of late we have been making the plans in the same way, but drawing heavy black ink lines on the tracing, so as to print broad lines. That is not as good, but it is necessary on account of the great expense involved in coloring so many prints.

Robert Ferriday (C., C., C. & St. L.): Does the term "railway tracks" mean existing tracks or old tracks?

Mr. Safford: It means existing tracks.

Mr. Ferriday: I suggest you use "existing tracks" for "old track to remain" and retain the symbol for "old track to be moved."

Mr. Safford: The committee will accept that.

Mr. Safford: In connection with the revision of the Manual, we have not attempted to make a general revision of some of the forms now existing, because we found that the character of the organizations of different roads cuts a great deal of figure in the character of form to be used, particularly bridge inspection reports. Therefore the committee has suggested that this study be continued, and as a basis for it, before attempting to make some classification of railway organization which we have in view, we have suggested that the matter be continued over until next year.

The conclusions under "Revision of Manual" were adopted.

WATER SERVICE.*

The following sub-committees were appointed:

Sub-Committee A—M. H. Wickhorst, J. L. Campbell. Revision of Manual.

Sub-Committee B—C. L. Ransom, W. A. Parker, A. D. Schermerhorn. Specifications for water tanks and trestle supports from 50,000 to 100,000 gallons capacity.

Sub-Committee C—Robert Ferriday, James Burke, G. H. Herrold. Friction factors for delivery pipe lines, such as used for water columns; also friction factors for water columns.

C. L. RANSOM.
Chairman Committee on Water Service.

Sub-Committee D—L. P. Rossiter, E. G. Lane, C. A. Morse. Types of track pans, with designs of typical installations and critical review.

Revision of the Manual.

The committee makes certain minor changes, mostly in wording.

All matter relating to "Function of a Water Station and Storage Tanks" is cut out, as the whole subject is being reconsidered.

Form M. W. 1302, Statement of Cost of Pumping Water. Add a column headed "Labor Cost," and change column now headed "Total Labor and Material" to "Material Cost."

Specifications for Water Tanks.

The specifications submitted at the last convention were referred back to the committee.

The committee endeavored to compile a specification for tanks as requested, without reference to any particular

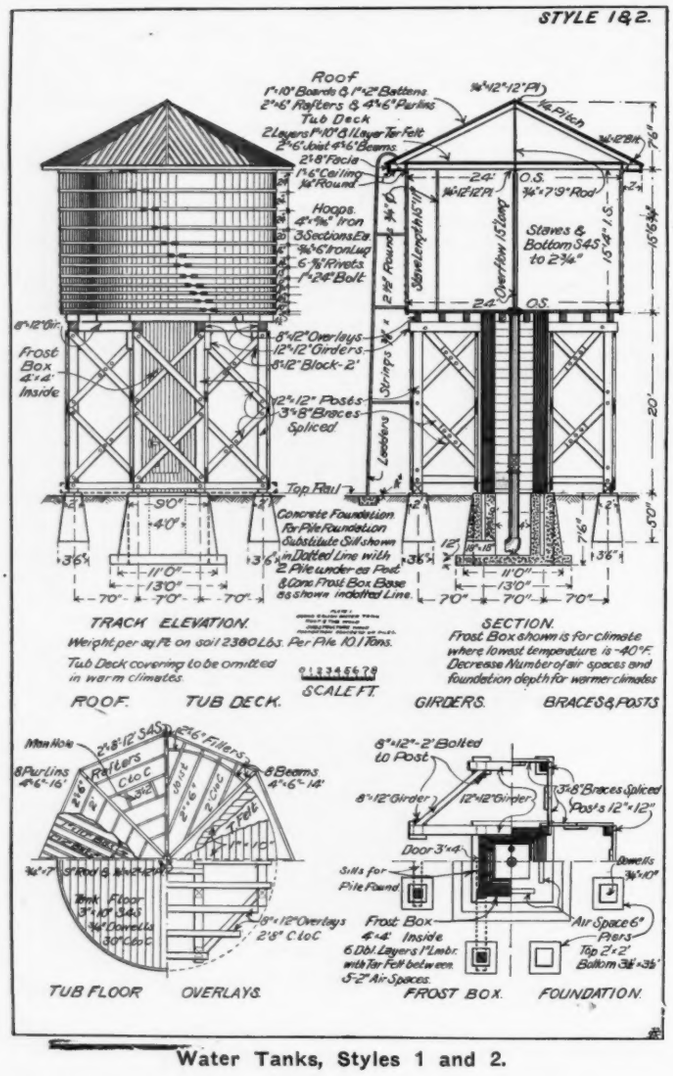
*From a report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

design, but working on these lines it has so far been unable to produce an intelligent specification which it is thought would be of any value to the association.

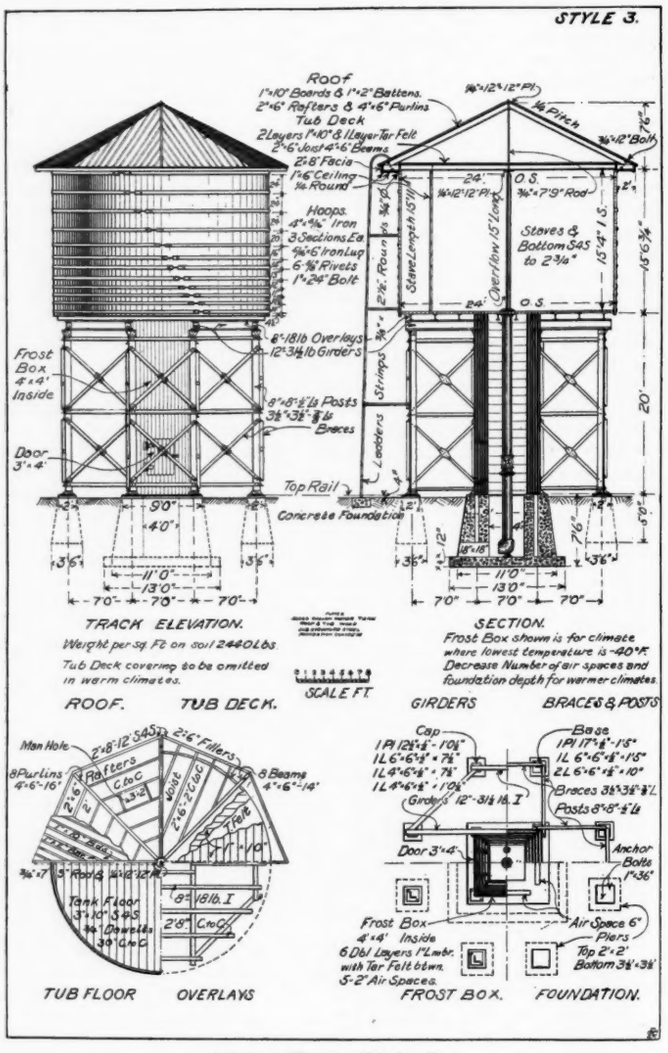
Failing in this, it was considered preferable to prepare designs of a general nature for different classes of tanks and make a comparative study of same as regards first cost, repair cost, interest cost, life of tank, cost of wrecking, scrap value and, finally, net cost of storage per year for 1,000 gallons.

In making this statement, Chicago prices were used, and each class of material was figured at the same price throughout all estimates.

It was found impossible to prepare plans for each style of tank for the 100,000-gallon tanks, so that the plans and estimates submitted cover the 50,000-gallon tank only. If the association approves of the plans submitted, and so



Water Tanks, Styles 1 and 2.



Water Tank, Style 3.

desires, the 100,000-gallon plans can be prepared for submission at a later date.

The specifications submitted are intended to cover the **whole question of 50,000 and 100,000-gallon tanks, and where** it is necessary to refer to the design, blank spaces are left and footnotes added to cover required information for each design submitted.

Specifications for 50,000 and 100,000-Gallon Water Tanks.

The general plan for the tank shall be as per Plate (1), Style (2), Capacity (3).

Foundation to be (4).

Substructure to be (5).

Tub to be (6).

Roof to be (7).

The foundation shall consist of (8).....

When concrete is used an additional pile foundation may be required, which will be added at an agreed price and of agreed design, when so directed by the engineer in charge.

Piles shall be round (9)..... in full accordance with the specifications of the association for No. 1 R. R. Grade, pages 541, 542, Vol. 10, Part 1, paragraphs 1 to 5. They shall be of length to be specified by the engineer, and driven as shown by Plate 1 to depth as directed by the engineer.

Excavation shall be made of sufficient size to permit forms to be built for sloping sides of concrete. Earth banks may be used for forms where faces are vertical and they stand firm.

Concrete shall be as per specifications of the association, pp. 1338 to 1342, Proceedings, Vol. 10, Part 2, paragraphs 1 to 6, inclusive, and 22 to 47, inclusive.

The substructure shall be (10) ..... Timber shall be No. 1 R. R. Grade (11), all as per specifications of the association, pp. 539 and 540, Vol. 10, Part 1, paragraphs 1 to 8, inclusive; all to be surfaced four sides for painting. All to be erected as shown on plans, in a good workmanlike manner, with well-fitted joints and proper fastenings.

Steel shall be open-hearth, as per specifications of the association, published in Manual of Recommended Practice,

[1] I, II, III, IV, V.
[2] Style 1-2-3-4-5-6.
[3] 50,000 or 100,000.
[4] Style 1, piles. Style 2-3-4-6, concrete. Style 5, crushed rock.
[5] Style 1-2, timber. Style 3-4, open-hearth steel. Styles 5 and 6, omit.
[6] Etyle 1-2-3, wood. Style 4-5-6, steel.
[7] Style 1-2-3, wood. Style 4-5-6, steel.
[8] Piles for 1. Concrete for 2-3-4-6. Crushed stone, 5.
[9] Specify kind of timber.
[10] Timber, 1-2. Open-hearth steel, 3-4. Cancel whole paragraph for styles 5 and 6.
[11] Give kind of timber available.

paragraphs 83 to 88, 92 to 105, 108 to 110, 111 to 116, 127 and 128, 144 to 158, inclusive, both as to material and workmanship.

All field connections shall be made with bolts.

The tub shall be built of (1).....

Dimensions and design shall conform to Plate.....

Timbers shall be carefully selected, free from sap, shakes, unsound knots or other imperfections which will impair the durability of the tub. All small black knots extending entirely through the plank shall be carefully bored and thoroughly plugged (2).

Staves shall be full length, without splicing. Joints shall be surfaced true and perfect and cut on radial lines. Outside of stave to be surfaced convex to the diameter of the tub. Crozing at bottom of stave to be cut circular, so that bottom will completely fill it when tub is drawn up. Staves six ⅝-inch iron rivets, countersunk on back side, and 1 in. by 24 in. bolt, 12-inch thread and hex nut and head. Hoops to be built in three equal sections and put on tub spaced as shown on plan.

Bottom of tub to be laid on overlays close together, with dowels in place and drawn tight and cleat tacked across to hold in place while staves are being placed. The setting-up staves to commence at the longest piece of bottom and driven only two-thirds depth of croze. When staves are all in place they are to be stayed with rope and then hoops to be put on, beginning at bottom. Hoops to be uniformly tightened. No lug to be placed on the same stave as any other lug. Steel shall be manufactured by the open-hearth process, and shall be in accordance with the specifications of the association as given under head of "Steel Substructure."

All tank plates must be bent cold.

Erection shall be in accordance with the specifications of the association, as given under head of "Steel Substructure," and also as follows:

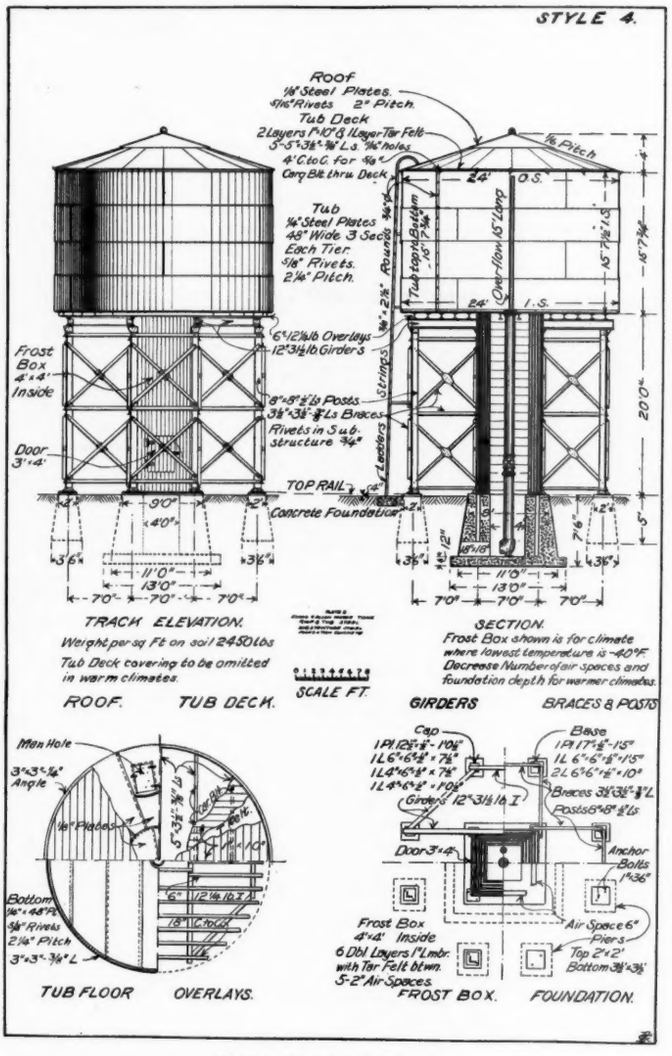
Joints must be made water-tight by caulking in such a manner as not to injure the abutting plate. No foreign substance of any kind will be permitted between plates.

Leaks which may develop after tank is filled with water must be recaulked until the tank is tight.

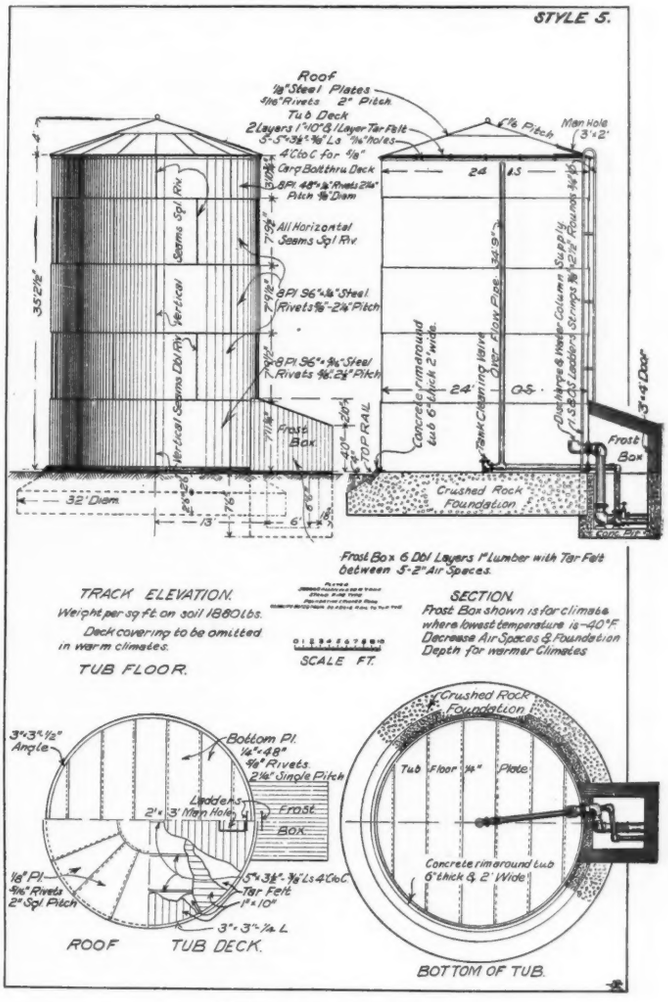
Indicator to be furnished and placed. Board to be white, with 6-inch black letters indicating feet, and furnished with chain, pulleys and galvanized iron float. Board to be set at least one inch clear of stave. Design to be approved by the engineer.

The roof shall be of (1)..... Dimensions and design shall be according to Plate.....

Dimension timbers and lumber not painted to be rough (2), free from large loose or unsound knots and other defects which will injure its strength and durability.



Water Tank, Style 4.



Water Tank, Style 5.

[1] Style 1-2-3, specify kind of lumber. The following kinds are suitable for the life given: White pine, 20 years; cypress, 25 years; redwood, 35 years; Douglas fir, 18 years. Plate IV, V, VI, open-hearth steel.

[2] Where cypress and redwood are used, omit sentence about black knots.

[1] Style 1-2-3, wood. Plate 4-5-6, open-hearth steel.

[2] Give kind timber available.

Finish lumber boards and battens to be (²).....,
free from defects, such as large or unsound knots, sap or checks, which will injure its durability.

Steel shall be same as specified for tub and erected in same manner, except that the caulking may be omitted.

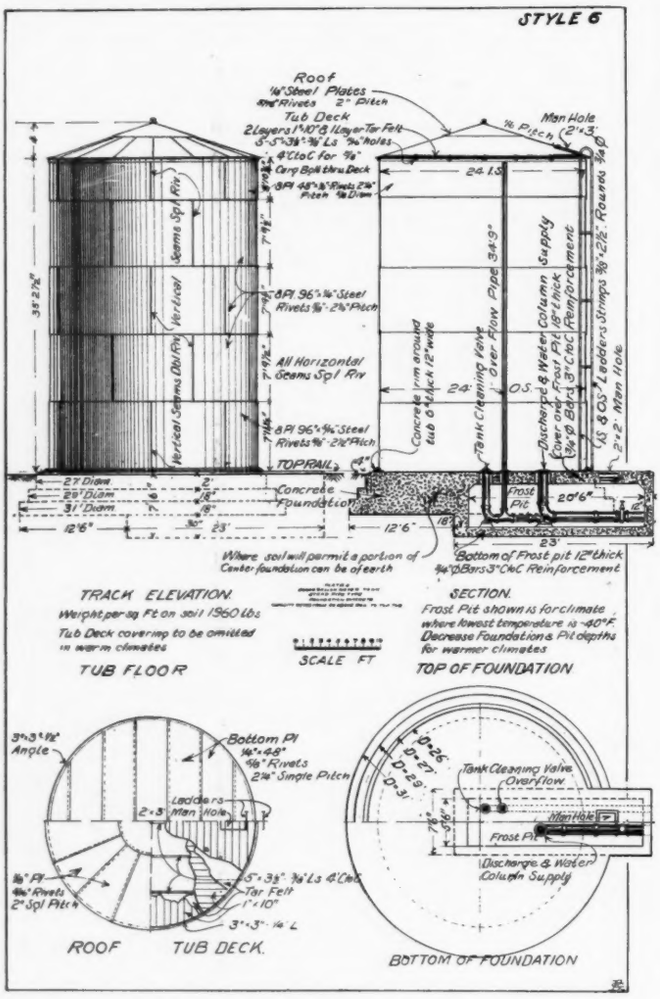
Provide trap doors of wood for wood roofs and of steel for steel roofs, not less than 2 ft. by 3 ft. clear opening in upper roof and tub decking. Doors to be hung with 8-in. heavy tee hinges and provided with 8-in. hinge hasp for fastening. All openings for doors to be framed so as to make structure of same strength as balance of roof.

(⁴) Frost box to be built for tanks as per plate.....
as shown on said plate.

Lumber shall be (²).....

Number of air spaces to be (⁵).....

Each inside layer to consist of two layers common 1-in. sheathing lumber S1S, with one layer of tar felt weighing



Water Tank, Style 6.

about 15 lbs. per 100 sq. ft. Air space to be made by 2 in. by 4 in. S1S and 1E, not over 2 ft. 6 in. center to center, erected vertically. Outside layers to be of one layer common 1-in. sheathing lumber S1S, one layer 15-lb. tar felt, and one layer 1-in. by 6-in. dressed, matched and beaded ceiling; all to be well nailed and erected in good, workmanlike manner.

Ladders inside and outside of tub to be of open-hearth steel, of design indicate on Plate....., all to be erected as shown on said plate.

Pipe connections to consist of (¹) ..... inch wrought-iron overflow pipe and ..... inch wrought-iron discharge or water column supply pipe, and for standpipe tanks a clean-out pipe.

Overflow pipe to extend to within 6 in. of top of stave or steel tub and there to be stayed to roof of tank. Discharge or water column pipe shall extend from floor of tank to bottom of frost box and be provided with flange union and two-ply rubber gasket, gate valve and base ell. Where both pipes pass through bottom of tank, there shall be two standard faced and drilled screwed flanges and two two-ply rubber gaskets for each pipe, both to be full bolted with standard number and size of bolts. Fittings for standpipe tank connections to be furnished and placed as indicated on Plates IV and V.

(²) Where called for in specifications (⁸) ..... inch outlet valve, outlet pipe supported on suitable brackets, and movable spout, with counterweights, etc., are to be provided and placed. For standpipe type of tank, outlet valve only is to be furnished and placed.

Outlet valve shall be cast-iron of the removable type, arranged with a cut-out device, so that valve can be removed for renewal of valve face rubber without emptying water in tank, and also so that it can be operated from the locomotive tender. Design to be approved by the engineer.

Outlet pipe to be cast-iron and to be conected to outlet valve with standard size faced and drilled flange, fastened with standard number and size of bolts, and to drop down and extend out to the distance, as required by the engineer. Lower end of outlet pipe to be supported by suitable brackets fastened to tank substructure and provided with face plate for spout to rest against. Design to be approved by the engineer.

Spout to be provided of suitable dimensions to reach from outlet pipe to locomotive tender. Dimensions of tenders to be furnished by the engineer. Spout to be provided with counterweights, pulleys, pull-down rope, etc., so that it can be reached from locomotive tender and will be securely held up above the clearance line when not in use. Clearance dimensions to be furnished by the engineer. Design to be approved by the engineer.

Exterior wood and iron work (lower part of bottom of steel tub included) to be painted three coats, inclusive of mill coat, of paint approved by the engineer. Separate paints for iron, steel and wood to be used, if required. Paint to be applied to surfaces when dry and free from rust or grease, and to be put on in the best manner and well brushed into the surface painted.

Steel and iron to receive one coat at the mill.

Exterior of wood tubs to be painted one coat before applying hoops.

Interior steel tubs, inside ladders and overflow pipe to be painted one coat at mill and one coat after erection, of paint or other compound approved by the engineer.

Interior of steel roofs to be painted one coat only, at mill.

The different styles shown on plates I, II, III, IV, V are recommended for use where their only object is supply of water to locomotives and not where there is a question of fire protection to be considered.

The different styles, 1, 2, 3, 4, 5, 6, are recommended for use where most of the following conditions obtain:

Style 1.—For water stations not at terminals.
- Soft moist ground at tank site.
- Location not permanent.
- Character of water such that steel tub would be apt to be corroded.
- Water carrying no sediment.
- Where fire risk is not great.

Style 2.—For water stations not at terminals.
- Good ground for foundation.
- Location not permanent.
- Character of water such that steel tub would be apt to be corroded.
- Water carrying no sediment.
- Where fire risk is not great.

Style 3.—For water stations not at terminals.
- Good ground for foundation.
- Location permanent.
- Character of water such that steel tub would be apt to be corroded.
- Water carrying no sediment.
- Where fire risk is not great.

[1] Specify kind lumber available.
[4] No frost box required for Plate VI. Cut out whole paragraph.
[5] Use 5 air spaces where lowest temperature is —40° Fahrenheit.
Use 4 air spaces where lowest temperature is —20 Fahrenheit.
Use 3 air spaces where lowest temperature is 0 Fahrenheit.
Use 2 air spaces where lowest temperature is +20 Fahrenheit.
Use 1 air space where lowest temperature is +30 Fahrenheit.
Omit frost box entirely where temperature never gets below freezing.

[1] Fill in size to suit local conditions.
[2] Cut out this paragraph, where location is such that locomotives are not required to take water direct from tank.
[8] Fill in size.

Style 4.—Water stations not at terminals.
Good ground for foundation.
Location permanent.
Character of water such that steel would not be corroded.
Water carrying no sediment.
Where the fire risk is to be considered.

Style 5.—Terminal water stations.
Good ground for foundation.
Slight settlement of tank not objectionable.
Character of water such that steel will not corrode.
Water carrying sediment.
Where the fire risk is to be considered.

At plants where water treatment is necessary, this style can be utilized as a settling tank, and also as a mixing tank, by building bottom inside of tank shown on inset at page 768, Vol. 10, Part I.

At terminal stations where increased storage under low head is valuable for washout water and filling locomotives by means of auxiliary pumps.

Style 6.—Recommended for the same conditions as Style 5, except it is to be used where slight settlement of tank is objectionable.

Conclusions.

That the association approve as good practice, publishing same in Manual, the designs for tanks, Plates I, II, III, IV, V, together with the specifications for 50,000 and 100,000 gallon tanks.

In Appendix A is given the report on friction factors for pipe lines and water columns, with the following conclusions:

Friction in Pipe Lines and Columns.

Definitions:—The Head at any point in the pipe of a gravity water supply system is the vertical distance, in feet, of the center of the pipe at that point below the plane of the free water surface.

The Pressure Head, at any point in the pipe of a gravity water supply system, is the head in feet which corresponds to the pressure in pounds per square inch at that point, and is obtained by multiplying the pressure by 2.304.

The Velocity Head is the term used to designate the expression $\frac{v^2}{2g}$ obtained from the formula giving the theoretic velocity of flow, $v = \sqrt{2gh}$, in which v = the velocity of flow in feet per second, g = the acceleration of gravity in feet per second (mean value 32.16).

The Velocity Head at any point in the pipe of a gravity water supply system is the head which could produce a theoretic velocity equal to the velocity at that point.

The Flow Head in a gravity water supply system is the difference in elevation which causes flow. It is the vertical distance, in feet, of the center of the end of a pipe, which discharges freely into the air, below the plane of the free water surface at the other end. If the discharge is submerged it is the vertical distance between the planes of the free water surfaces.

Formula.—The flow head equals the sum of the lost heads plus the velocity and pressure heads of the issuing stream.

$$H = m\frac{v^2}{2g} + \frac{V^2}{2g} + h_e + h_t + h_p + h_n + h$$

in which H = Flow head in feet.
h = Pressure head of issuing stream = O.
$m\frac{v^2}{2g}$ = Head (in feet) lost at entrance to pipe line, in which m is a constant which varies from 1.00 for a pipe extending into the tank, to 0.00 for a perfect mouth piece. $\frac{v^2}{2g}$ may be obtained from diagram for "velocity head in feet;" see Fig. 28.
$\frac{V^2}{2g}$ = Velocity head (in feet) of issuing stream; see Fig. 28.
h_e = Head lost (in feet) in overcoming friction in all elbows; see Fig. 28.
h_t = Head lost (in feet) in overcoming friction in all tees; see Fig. 28.
h_p = Head lost (in feet) in overcoming friction in all pipe lines; see Figs. 26 and 27.
h_n = Head lost (in feet) for the type of column used; see Figs. 3, 5, 7, 9, 11, 13, 15, 17, 19, 21.

Problem 1. Given the composition of delivery line from storage tank and the required discharge. To find the flow head.

From Fig. 28 find the velocity head at entrance, which multiplied by the usual value of m, viz., 1.0, gives the loss at entrance. From the same figure find the velocity head of the issuing stream; also the head lost in one elbow or tee of each size used, and multiply by the total number of each. From Figs. 26 and 27 find the head lost in 100 ft. of pipe for the various sizes in the line, and with this find the loss in each length of same size and add these totals to get the total friction in straight pipe. From one of the figures 3 to 21 find the head lost in type of water column to be used. The sum of these lost heads and the velocity head equals the flow head.

Problem 2. Given the composition of delivery line from

COMPARATIVE STATEMENT OF WATER TANK COSTS—PLATE VII.

Style Number.	1	2	3	4	5	6	7
Foundation Material	Piles	Concrete	Concrete	Concrete	Crushed Stone	Concrete	Concrete
Substructure Material	Timber	Timber	Steel	Steel	Steel Stand Pipe	Steel Stand Pipe	Steel, 4
Tub Material	Wood	Wood	Wood	Steel	Steel Stand Pipe	Steel Stand Pipe	Wood
Roof Material	Wood	Wood	Wood	Steel	Steel	Steel	Wood
Costs as follows:							
Foundation	$ 300.00	$ 244.50	$ 244.50	$ 244.50	$ 402.50	$ 796.50	$ 252.25
Substructure	190.17	158.77	1,069.00	1,069.00	1,673.00	1,673.00	1,365.80
Tub	503.37	503.37	503.37	748.00	1,673.00	1,673.00	503.37
Roof	106.54	106.54	106.54	54.62	54.62	54.62	106.54
Frost Proof Deck at Roof	56.38	56.38	56.38	56.62	56.62	56.62	56.38
Frost Box Below Tub	187.90	187.90	187.90	187.90	96.25	None	187.90
Piping in Frost Box	158.40	158.40	158.40	158.40	200.30	176.30	158.40
Ladders	30.20	30.20	30.20	0.20	35.00	41.00	30.20
Total First Cost	$ 1,532.96	$ 1,446.06	$ 2,356.29	$ 2,549.24	$ 2,518.29	$ 2,798.04	$ 2,660.84
Estimated Life in Years	20	20	20	40	40	40	20
Weight per sq. ft. on Soil, lbs.	per pile 20,203	2,380	2,440	2,450	1,720	1,890	2,500
Scrap Value less cost of Wrecking	$ 12.50	$ 12.50	$ 170.00	$ 300.00	$ 135.00	$ 135.00	$ 85.00
Net Cost	1,520.46	1,433.56	2,186.29	2,249.24	2,383.29	2,563.04	2,375.84
Repairs During Life	520.00	520.00	182.50	689.50	682.50	682.50	184.00
Interest on first Cost at 5 per cent. for Life of Tank	1,532.96	1,446.06	2,356.29	5,098.48	5,036.58	5,596.08	2,660.84
Total Final Cost	$3,573.42	$ 3,399.62	$ 4,725.08	$ 8,037.22	$ 8,102.37	$ 8,841.62	$ 5,220.68
First cost per 1,000 Gallons	$ 3.06	$ 2.89	$ 4.71	$ 5.10	$ 5.04	$ 5.59	$ 5.32
Final cost per 1,000 Gallons, per annum	3.57	3.39	4.72	4.02	4.05	4.42	5.22
	Renewal Substructure Once. Repair Frost Box Once Paint every 3 Years, 2 Coats= 5 Paintings.	Renewal Substructure Once. Repair Frost Box Once Paint every 3 Years, 2 Coats= 5 Paintings.	Paint every 3 Years, 2 Coats =5 Paintings.	Paint every 3 Years, 2 Coats. O. S.=12 Paintings and 2 Coats, ½ I. S.= 12 Paintings.	Paint every 3 Years, 2 Coats O. S. = 12 Paintings and 2 Coats, ½ I. S.=12 Paintings.	Paint every 3 Years, 2 Coats O. S. = 12 Paintings and 2 coats ½ I. S.=12 Paintings.	Paint every 3 Years, 2 Coats O. S. = 5 Paintings.

storage tank and the height of water in same above the rail. To find the discharge.

(a) Find available flow head by deducting the height of free discharging end from height of water in the tank. (b) Assume a discharge and compute flow head as in Problem 1. (c) Divide the loss in the column for assumed discharge by this computed flow head. This will give the trial ratio. (d) Multiply available flow head by this trial ratio. This will give the column loss which may be expected with the available head. (e) With column loss find corresponding discharge, from column loss diagram. (f) As a check, use computed discharge, solve as in Problem 1 and obtain flow head. This should come out approximately equal to given flow head (a). If the result is not close enough, take the value found (e) as the assumed discharge and again run through steps indicated. This will rarely be necessary.

A critical inspection of the head lost in each portion of the delivery line will develop where to economically decrease the loss in head by increasing the sectional area.

The diagrams of pipe friction refer to new cast-iron pipe. Allowance must be made for pipes becoming tuberculated and for incrustations of treated water. (The former alone may decrease the discharge 20 per cent. in 20 years.) These facts and the possibility of future demand for discharge larger than required when designed, suggest the advisability of selecting pipes larger than developed by the calculations.

Ultimate economy in water station design is secured by comparing the interest on investment with the cost of pumping for several combinations of delivery line and flow head.

Appendix A also contains a report on water columns, friction in straight line and friction in elbows and tees.

Appendix B is a report of experiments on water columns at the hydraulic laboratory of the University of Illinois, by Prof. Arthur N. Talbot. Appendix C consists of diagrams of friction of water in new, straight, cast-iron pipe, and Appendix D is a bibliography.

Conclusions.

(1) The conclusions under "Friction in Pipe Lines and Columns," Appendix A, are essential to a full understanding of the subject and should accompany the diagrams when published in the Manual.

(2) The views of water columns and the diagrams of head lost therein (Figs. 2 to 22, incl., Appendix B) are recommended for publication in the Manual.

(3) The diagrams of head lost in straight pipe (Figs. 26 and 27, Appendix C) are recommended for publication in the Manual.

(4) The diagrams for head lost in tees and elbows and for values of the velocity heads (Fig. 28, Appendix C) are recommended for publication in the Manual.

The report is signed by: C. L. Ransom (C. & N. W.), chairman; M. H. Wickhorst (C., B. & Q.), vice-chairman; James Burke (Erie), J. L. Campbell (E. P. & S. W.), Robert Ferriday(C., C., C. & St. L.), G. H. Herrold (C. G. W.), E. G. Lane (B. & O.), C. A. Morse (A., T. & S. F.), W. A. Parker (St. Joseph & Grand Island), L. P. Rossiter (B. & O.) and A. D. Schermerhorn (Un. Pac.),

Discussion on Water Service.

The minor changes recommended for the revision of the Manual were adopted.

C. L. Ransom (C. & N. W.): The approval of the specifications for 50,000 and 100,000-gallon tanks is desired. In explanation of the five designs of tanks submitted, the attention of the convention is called to the table on page 204. Since these tables have been compiled, one or two minor errors in the calculations have been found; but these errors will not materially change the figures at the bottom of the page, that is, the first cost per thousand gallons and the final cost per thousand gallons handled.

The secrtary read the specifications.

G. W. Kittredge (N. Y. C. & H. R.): These specifications would seem to bar the use of half-round or round hoops.

Mr. Ransom: The committee had more discussion on this hoop matter than on any other feature of tub design. The round hoops were suggested, but we were unable to find anyone who had used them over two or three years, so that we felt it was rather a radical departure from the old practice and hardly to be considered at the present time. So far as half-round hoops are concerned, it looked as though they would be very satisfactory, but the same objection was open to them, that they had been very little used. We have on the table a portion of a flat tank hoop which has been in service for 23 years, of wrought iron, which shows very little deterioration, and the committee thought it was safe in recommending that style of hoop.

Mr. Kittredge: I think the field ought to be left open for the use of either the round or the half-round hoop. I believe we are going to get better service from these hoops than the flat hoops. It is simply a detail as to manufacture. With the flat hoop, unless you take the hoops off entirely and paint them on the underside as well as the outside, after a few years you are liable to have a dangerous condition which will not appear from external observation.

Mr. Ransom: The committee is willing to accept that suggestion. The reason it was worded in this way was to bring out some discussion. We were not able to get any discussion last year on this same subject that amounted to anything, or get any information from the members as to the hoops, and we worded it in this way more to bring out discussion than anything else.

J. C. Nelson (S. A. L.): During 1909 we lost three tanks because of flat hoops rusting on the inside. They were not observed to be rusted to any appreciable extent, and the tanks bust without any warning whatever. I have been trying to find something that would be satisfactory any have recently used round hoops.

Mr. Ransom: Were those hoops made of steel or wrought iron?

Mr. Nelson: I do not know. They were in service only about six years. We have a very hard condition down in Florida in the salt air. It seems to get in behind the hoops, next to the staves, and rot the hoops, whether they are made of steel or iron.

Mr. Stein: We have known of a number of cases where the flat iron hoops have given out and the tank has failed. In each case they were steel and not iron. A substitution of a round iron bar was made. I do not know of a single case where a flat wrought iron hoop failed, but I do know that the steel hoops deteriorated very materially. Between the hoop and the tank corrosion would go on very rapidly; the effect of the rusting would run down the tank inside of a year and make the tank appear as if it had not been painted for eight or ten years. I know where substitutions were made of round iron bars, in place of these flat hoops. The hoops have been in service as much as six years, and at present there is not a particle of evidence of deterioration.

Mr. Courtenay: Our supervisors, who are in immediate charge of water stations, maintain steadily that cypress tubs with steel hoops will rust the hoops quicker than any other type of tub. They maintain there is some kind of peculiar acid in the cypress which attacks the steel. At any rate, the trouble with steel hoops has been so great on the L. & N. that we have changed to a standard round hoop. As Mr. Kittredge observed, it is impossible to paint the underside of these steel hoops without taking them off the tubs. It frequently occurs that the hoop is apparently good, from the outside indications, but, as a matter of fact, may be pitted almost entirely through and extremely weak. The L. & N. used round hoops at least 25 years ago. For many years we specified iron hoops, but did not get them; we got steel hoops. Our experience is that the loss with flat hoops has been sufficient to justify the change to round hoops.

Mr. Loweth: About six years ago the St. Paul used four or five tanks with round hoops, and as a result of our experience that year and observation of these tanks the next year the round hoop will become the standard on the St. Paul. We have been using round steel hoops for the past three or four years. We use the steel hoop because we think with a round hoop we can protect the steel as well as we can the iron. It is difficult nowadays to find good wrought iron, and by using the steel hoop we save ourselves a good deal of trouble and annoyance in trying to get iron in place of steel. I feel we will not have to paint the hoops on our tubs any oftener than we will have to paint the tank for general purposes.

Mr. Lindsay: We used the flat hoop largely and had to take them off to repaint them. We have begun to experiment with the round hoop, and find a decided advantage in their use, except that the round hoop indents the wood in the tub. We have decided to use ¾-in. round iron, which will obviate that difficulty, so that in changing the adjustment of the hoop it will not leave the furrow.

Prof. W. D. Pence (Univ. of Wis.): The investigation I made of the failure of water tanks a few years ago led me to the conclusion that the form of the hoop should be given special attention. As a result of these studies, and conference with the representatives of the insurance companies, it seems to me that the suggestions made by Mr. Loweth and

others will be the means of procuring decided improvement in the hoops.

Mr. McDonald: My impression is that the National Board of Fire Underwriters require the use of round hoops.

J. M. Meade (A., T. & S. F.): Will some of these gentlemen who are speaking of the round hoops give the diameter of them?

Mr. McDonald: That depends on their position.

Mr. Courtenay: Our practice is ¾ in.

Mr. Kittredge: Do I understand that the chairman will make some reference to the round hoop so that it will not be barred?

Mr. Ransom: The committee will accept that.

The secretary continued to read the specifications.

Prof. Pence: Cross reference is made to the steel substructure adopted in the specification of the association. Does that mean the specification for iron and steel bridges?

Mr. Ransom: It is the same as referred to in the paragraph on substructure.

Prof. Pence: I think more attention is needed to certain details of that question than is covered in that paragraph.

Mr. Ransom: The committee went over that pretty thoroughly, and in taking out these paragraphs we have suggested here they felt that they had practically covered the erection of tanks with the addition of these paragraphs which are added.

Prof Pence: It seems to me that these specifications would not give the results that the committee is seeking to recommend. I am unable offhand to make any suggestions. I think the committee should withhold making this as their recommendation. It is not in line with the specification.

The secretary continued to read the specifications.

Mr. Stein: Is the supply pipe to be connected to the tank by these screwed flanges also?

Mr. Ransom: Yes.

Mr. Stein: I presume also there is an automatic valve in the tank to close it off at the proper point?

Mr. Ransom: No, there is a gate valve in the frost box.

Mr. Stein: There is a gage in the frost box, but don't you have an automatic valve in the tank?

Mr. Ransom: No, not unless required.

Mr. Stein: Is not that customary?

Mr. Ransom: Not always. You mean a floating valve.

Mr. Stein: A floating valve to automatically cut off the water supply.

Mr. Ransom: That would be a detail of the system and would not go into the specifications for a tank.

Mr. Stein: I know of a case where the water pressure was extremely high, and just at the moment the automatic valve cut off that water supply, throwing the entire pressure into this supply line and to the bottom of the tub, the water would invariably leak between these flanges and the bottom of the tub and run down into the frost box, taking with it the waterproofing material. It was necessary to run the pipe through a stuffing box in the bottom of the tank. That is necessary where your pressure is not more than 30 to 60 lbs. Where you run to a pressure of 80 to 100 lbs., you can hardly prevent leakage by the system of screwed flanges. I think this point should be taken care of in the specifications.

J. L. Campbell (E. P. S. W.): In cases where we have the water supply from a city line, or pipe line, under high pressure, I think that a form of floating valve should be adopted that would eliminate the water hammer. The ordinary hydraulic valve that will close within a few seconds will cause a water hammer on the line.

Mr. Stein: I am not referring to a water hammer, but direct pressure, and until you turn off the valve in your frost box you have the pressure from the point where the automatic valve begins to work down through the supply line.

Mr. Campbell: I understand you had trouble from leakage.

Mr. Stein: Yes.

Mr. Campbell: That is not my experience. With a good gasket joint there is no trouble in making a joint tight at 100 lbs.

E. J. Correll (Mo. Pac.): What is the objection to using cast iron pipe for the supply pipe?

Mr. Ransom: I do not know that there is any objection, except that it requires flanged joints or leaded joints. Leaded joints would seem somewhat objectionable in frost boxes.

Mr. Correll: If that is the only objection to cast iron, why not change it? I move to strike out the word "wrought" and leave the character of iron blank.

The secretary continued to read the specifications.

Mr. Ransom: I would like to make a slight correction. The matter of clean-out valve was omitted, and the committee would change this paragraph to read: "Outlet, or clean-out valve shall be of cast iron of the removable type, arranged with cut-out device, so that valve can be removed for the renewal of valve face rubber without emptying water in tank, and also that it can be operated from the locomotive tender, for outlet valve, and from the roof of the tank for clean-out valve. Design to be approved by the engineer.

The President: If there is no objection that will be considered approved.

The secretary continued to read.

Mr. Lindsay: I do not find any reference to the painting of the hoop.

Mr. Ransom: It says that steel and iron work shall receive one coat at the mills, that includes hoops. They would be painted two coats afterwards as directed.

Mr. Ewing: Has the committee given any consideration to the matter of the use of a permanent sub-structure other than steel, the use of a brick or masonry circular wall, which has the advantage of the elimination of frost boxes?

Mr. Ransom: The committee did not go into that this year. It was intended, if this tank matter were continued, to investigate something of that sort and also, in later years, the reinforced concrete tank.

A. F. Robinson (A. T. & S. F.): I suggest that the specifications do not cover at all clearly the matter of the metal to be used on the tanks, the matter of beveling the plates, bending, assembling, riveting, caulking, and similar matters. On our road we use a good many steel tanks and I am sorry to say that I do not think there are a half dozen that do not leak. We might make our specification in the present case so clear and so carefully worded that it will be easily understood. It would make the specifications complete and serviceable. I suggest that the committee hold this item and work on it for the coming year.

Mr. Ransom: The committee is willing to accept that suggestion and will be glad to co-operate with any of the members who have specifications that will help us in our work.

Mr. McDonald: In view of the fact that there has been a discussion here of value on quite a number of points upon which the committee has been unable to get any discussion before, and in view of the fact that it will probably be the action of the board of direction to ask the committee to study the question with reference to water tank supports of concrete, and water tanks of concrete, I suggest that the committee take the entire report and give it further study, with a view of boiling it down a little more and report definitely on some of the points that have been discussed. I do not believe that the report in its present shape can be published in the Manual.

Mr. Ransom: The instructions of the board of direction were quite explicit and did not include concrete tanks.

Mr. McDonald: I am simply forecasting the action of the board, as I happen to know what the program is for next year.

Mr. Loweth: If this report is to be referred back to the committee, I suggest the advisability of dividing the specifications so as to get a complete specification for timber tanks and another complete and separate specification for steel tanks. I believe that would be clearer. I suggest that the plans include the cone roof. We have the octagonal roof, and the cone roof has the advantage of being cheaper and, to many, looks as good. I thing an alternative sketch should show the cone roof. I also suggest an alternative plan omitting decking on top of the tubs. We inaugurated that practice several years ago and we have seen no reason for going back to the decking. I think it would be desirable to consider the question of reducing the width of the timber overlays.

Mr. McDonald: We could not dispense with the covering on tubs in the South. The growth of algae makes it necessary to cover them.

Mr. Loweth: My idea is that the plans should show a tub covering and also an alternative sketch showing the tub without the covering.

Mr. Cushing: The result of our investigation in the matter of steel supports for tanks is that there should be only four supports instead of twelve, for the reason that the additional number of supports brings the thickness of the steel used down to too small gages, and it is better to compact the steel into a few supports which are more durable.

Mr. Ransom: The committee had both styles of tanks, four and twelve posts, analyzed, and taking into consideration the foundations and all other features, we found the four-post design was more expensive.

Mr. Cushing: It is not a question of cost, but a question

of durability of material. In bridge work our company will not allow the use of anything less than ⅜-in. thick, and I don't suppose anyone else does.

Mr. Ransom: The columns on the steel substructure are of 8-in. x 3-in. x ½-in. angles.

Mr. Lindsay: I would like to have the question of making the pitch on the wood tank roof the same as the pitch on the steel tank roof considered. We use the low pitch now on our wooden tanks and they look very well.

The President: I understand the committee will be glad to act on Mr. Loweth's suggestion, and it is so ordered.

Mr. Ferriday: With reference to Appendix A, I would like to call attention to what I feel is the most interesting part of our report, apart from the tests themselves. That is the analysis, all of which is interesting, but particularly the part on page 222. It is the usual practice to lay a 14-in. line to a 12-in. column, or 12-in. line to a 12-in. column. If you will refer to page 224, a table which gives the interpretation of table of flue heads, I would like to call your attention to these interesting conditions. Combinations 7 and 8 show the maximum and minimum discharge with 10-in. supply by 10-in. pipe instead of 12-in. pipe, since the length is only 200 ft. In minimum discharge we have assumed that about 5 ft. would be the allowable minimum for the water to get into the tank. The other condition is where the tank is full. In other words, if a 10-in. pipe supplies a 12-in. column, a large portion of the 12-in. outlet would not be filled with water, and the water would spray, but that could be coned down to the necessary amount. Another interesting paragraph is that showing a maximum practice, combination 21, which is a 16-ft. tub on a 32-ft. substructure, taken as the average height of the tank. With this 100-ft. of 14-in. pipe, supplying a 12-in. column, will deliver 6000 gallons a minute.

SIGNS, FENCES AND CROSSINGS.*

The following subjects were assigned:

(1) Consider revision of Manual.

(2) Report on ways and means for securing a proper quality of fence wire to resist corrosion and secure durability.

(3) Rewrite detailed matter accompanying conclusions adopted at the tenth annual convention, with a view to brevity, and furnish plans to explain them.

(4) Continue investigation of the use of concrete fence posts, and submit recommendations.

(5) Investigate the best form of flangeways at crossings.

W. D. WILLIAMS,
Chairman Committee on Signs, Fences and Crossings.

Revision of Manual.

The committee has made a revision of the matter in the Manual. The following changes are those which are more than simply changes in wording:

Under "Fences, Recommended Practice" omit: "The use of heavier smooth wire than has generally been adopted is recommended."

Under "Surface Cattle Guards," omit: "It should be so constructed as to overcome the objectionable features of the pit guard, particularly so far as endangering trains is concerned."

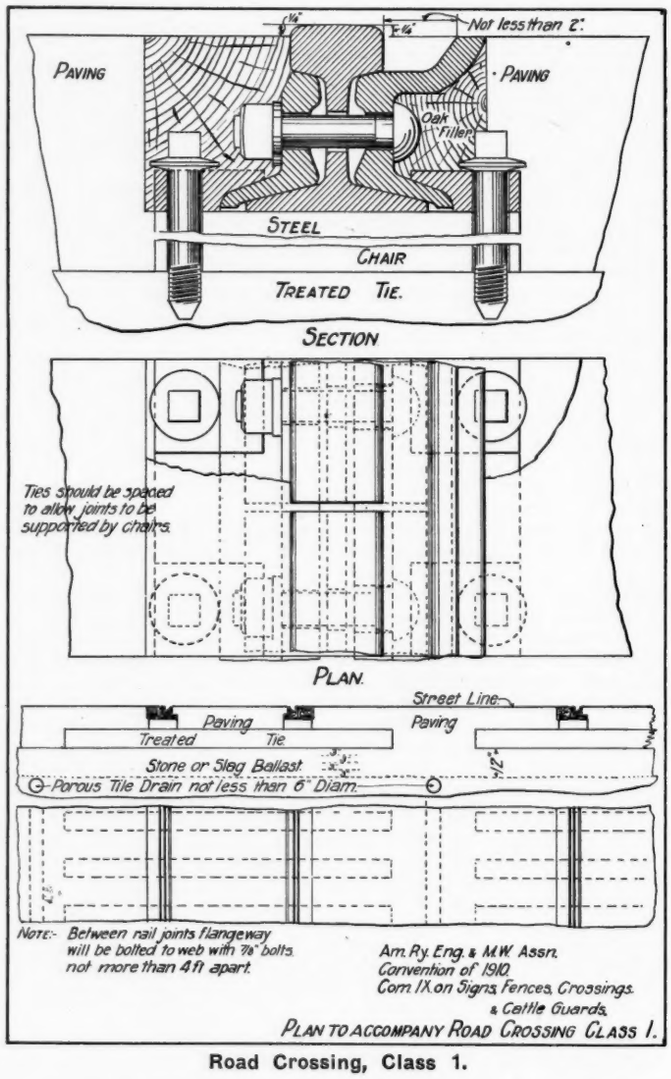
Under the specifications for third class fences, omit: "When desirable, 1 in. x 2 in. wooden stays * * * interlaced between the longitudinal wires, may be used," etc.

Insert the following in place of the present specifications for braces:

"Braces for end posts, gate posts and intermediate brace panels shall be common fence posts or 4x4 in. common lumber, free from large knots, splits or rot."

Change the specifications for the erection of bracing accordingly.

Omit the matter under "Tensile Strength of Fence Wire." Substitute the following paragraphs for the first two under "Gates:"



Road Crossing, Class 1.

"A hinged metal gate is recommended.

"The width of farm gates should be not less than 12 ft., depending upon the size of agricultural machinery in use in the vicinity, or as required by the laws of the state through which the railway operates. The minimum height of farm gates should be 4 ft. 6 in. from the surface of the roadway."

Proper Quality of Fence Wire.

The committee has not yet been able to gather sufficient data to warrant any recommendations.

Tests are being made by the American Society for Testing Materials on wires protected by different methods, such as galvanizing, copper-plating, sherardizing, electro-plating and paint. The Paint Manufacturers' Association is making a practical field test of the value of various pigments.

One manufacturer reports an improved process by which he can put a heavier coating of zinc on the wire without having it crack or peel off during fabrication into fencing.

*From a report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

Several roads and several members of the committee are now experimenting with and testing out a new form of wire fence—"galvanized after weaving." The tests were started in April, 1909. The committee recommends the continuation of the consideration of this subject for another year.

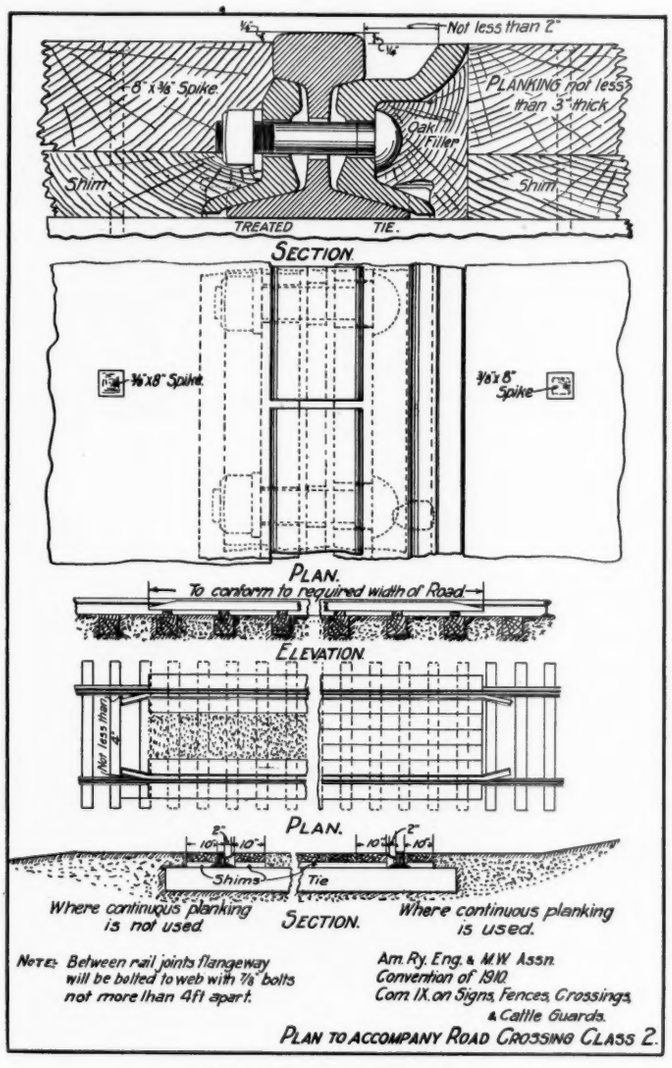
Grade Crossings.

A sub-committee has rewritten the detailed matter making recommendations as to proper construction of grade crossings adopted last year. It also submits drawings showing: (1) Crossings where paving is required to conform to street specifications. (2) Crossings of streets where no paving is required. (3) Crossings of public roads or highways outside of towns or cities. (4) Crossings of private or farm roads.

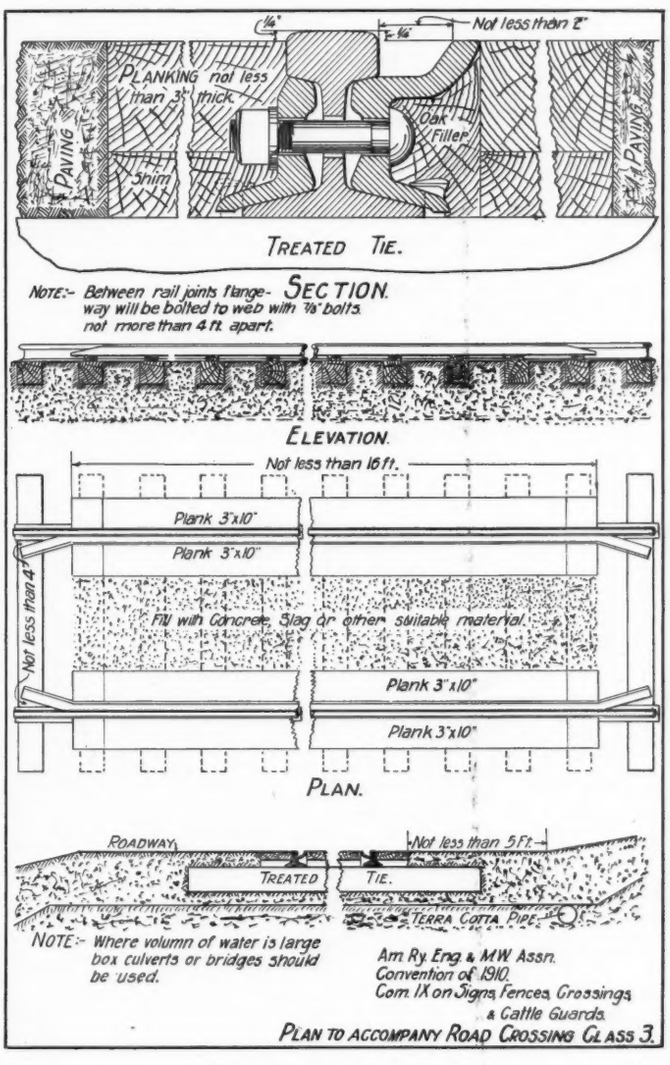
Snow Fences, Snow Sheds and Methods for Snow Removal.

The recommended practice adopted, as shown in Vol. 10, 1909, pp. 877, 881-897, 915-917, is presented for insertion in the Manual, with slight modifications in phraseology.

For illustrations of various types of portable and permanent snow fences and snow sheds, reference is made to Vol. 10, pp. 887, 888, 893-897.



Road Crossing, Class 2.



Road Crossing, Class 3.

Concrete Fence Posts.

The committee continued the investigation of this matter, begun last year. It finds that reinforced concrete fence posts are not in use to any large extent in foreign countries.

One of the members of the committee has been experimenting during the past several years, and proposes this year to erect wood posts in concrete every 20 to 30 rods as straining posts for American woven wire fence, the experimental reinforced concrete posts to form the line posts set a rod apart. After the line posts have seasoned for 90 days this fence will be built across a marsh, the long, coarse, heavy grass of which is burnt over every summer or fall. This marsh is a frozen lake in winter and a sea of floating ice in spring. A fence of wood posts will not endure for two years in this swamp. He will also place concrete posts across a marl pan, where wood posts heave out of the ground every spring.

The committee considers that the following facts have been established:

1. Concrete fence posts will heave very little, and in most cases not at all; posts set from two to five years ago are still in almost perfect alinement.
2. They appear sufficiently strong for all practical purposes after having been properly cured and set.

A cedar post of dimensions identical with the average concrete post would weigh about one-fourth as much and is about four times as strong when new, but this only brings out the fact that the cedar post is stronger than necessary, and that the concrete post, with its lesser strength, is yet strong enough to serve its purpose, and has a longer life.

3. The claim that a concrete post, reinforced with steel, forms a lightning protector appears reasonable.
4. They resist the action of fire and decay, and will not float and cannot be displaced as easily as wood.
5. They must be handled carefully in loading and unloading, and be well cured before being set.
6. They are much heavier than wood posts, and the cost of distributing and setting is about 25 per cent. greater.

Flangeways at Road Crossings.

This subject was considered in connection with the third clause of the committee assignment, but it is not prepared to offer anything further this year than what it has presented in its recommendations under that clause.

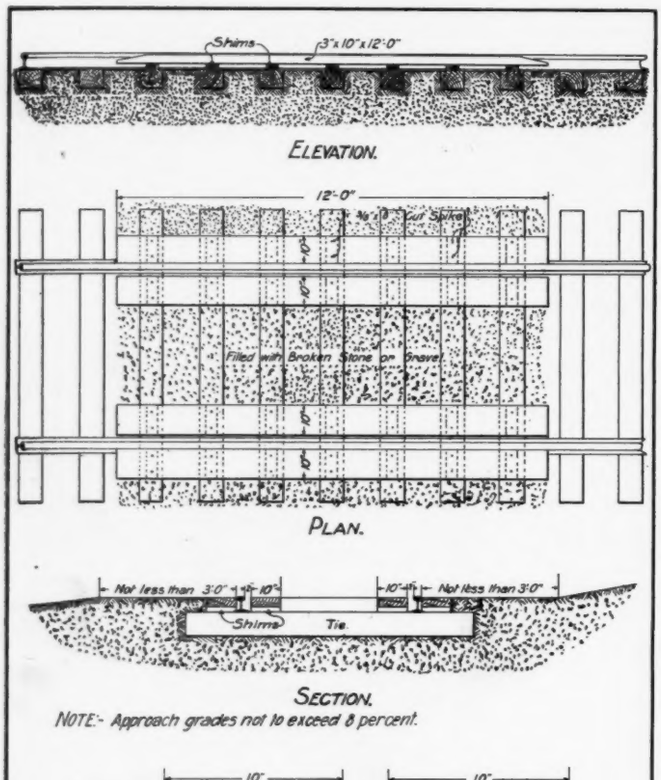
Conclusions.

The committee recommends the adoption of the following conclusions for publication in the Manual:

1. That the revision of the Manual as recommended be approved as good practice, and that tables and illustrations referred to be included in the Manual.

2. That the recommendations made in the rewriting and revision of the detailed matter accompanying conclusions adopted at tenth annual convention, and plans accompanying same affecting the proper construction of grade crossings and snow fences, snow sheds and recommended methods for snow removal, be approved as good practice.

The report is signed by: W. D. Williams (Cin. Nor.), chairman; K. J. C. Zink (Gr. Tr. Pac.), vice-chairman; A. G. Boughner (B. & O.), A. E. Doucet (Transcontinental Ry.), A. M. Funk (B. & O.), Paul Hamilton (C., C., C. & St. L.), C. W. Johns (C. & O.), H. L. Laughlin (M., St. P. & S. S. M.), E. R. Lewis (Mich. Cent.), J. W. Orrock (Can. Pac.), P. Petri (B. & O.), C. H. Stein (Cent. of N. J.) and E. J. Steinbeck (Ill. Cent.).



Road Crossing, Class 4.

Discussion on Signs.

The conclusions under Appendix A were adopted.

Discussion on Signs, Fences and Crossings.

W. D. Williams (Cin. Nor.): The committee is not ready to recommend the plans submitted in the Bulletin but merely submits them for discussion.

The conclusions of the report were adopted.

The President: Does the chairman of the committee wish anything brought up in regard to concrete fence posts?

Mr. Williams: We haven't anything to offer further than what is printed in the Bulletin, other than for information.

The President: The matter on page 83 has been submitted for information only.

Mr. Kittredge: I desire to offer the following resolution:

Resolved, That the members of the American Railway Engineering and Maintenance of Way Association, in annual convention assembled, desire to express their hearty appreciation of the efforts made and the admirable results obtained by the Railway Age Gazette in its daily issue during this convention:

Resolved, That the cordial thanks of the association be extended to its managing officers and editorial staff;

Resolved, That a copy of these resolutions be spread upon the minutes of this convention and a copy transmitted to the Railway Age Gazette.

The President: It is unnecessary to ask you if you are ready for the question, but I do ask you to signify your approval in a good, hearty way.

The resolution was unanimously adopted.

Mr. McDonald: I desire to offer the following resolution:

Resolved, That the members of the American Railway Engineering and Maintenance of Way Association, in annual convention assembled, desire to express their hearty appreciation of the efforts made and the admirable results obtained by the Railway and Engineering Review in its daily issue during this convention;

Resolved, That the cordial thanks of the Association be extended to its managing officers and editorial staff;

Resolved, That a copy of these resolutions be spread upon the minutes of this convention and a copy transmitted to the Railway and Engineering Review.

The resolution was unanimously adopted.

Mr. Wendt: I am sure that all who attended the Coliseum this week were impressed with the splendid exhibition of railway appliances. I, therefore, move that as an association we recognize the merits of the exhibition referred to and commend the Road and Track Supply Association for the high standard on which the exhibition has been conducted, and that a copy of this resolution be forwarded by our secretary to the officers of the Road and Track Supply Association.

The motion was unanimously carried.

The Secretary: No reports have been presented by the Committee on Uniform General Contract Forms, the Committee on Brine Drippings from Refrigerator Cars, nor the special committee co-operating with the National Advisory Board on Fuels and Structural Materials. Those matters are still under consideration and the committees only report progress.

The President: We are fortunate enough to have with us today four of our past presidents, and I will request them to assist me on the platform by taking chairs here.

President McNab: Gentlemen, I take this opportunity, as I may not get it again at this convention, of expressing to you my appreciation of your kindness to me while I have occupied this honored chair. I do not think that there is any position in this country where railway engineers are concerned that is more honorable than being president of this association, and I only wish that it could be that it would come to you all in turn, but that is impossible. Let me, however, put it up to you as an ambition to look forward to, and I am sure that you will find that what I have said is correct, that there is no position in the railway engineering world more to be desired than the presidency of this association. I, perhaps, can speak with a little feeling on that point, as I have been connected with the association since its inception. I have seen it grow. I have been in close touch with the majority of our members. I have been associated with my honored friends here on the platform since the association was started, and I have observed it wield a great influence in the railway world. I am perfectly satisfied that the physical status of the great railways, the great trunk lines and most of the railways of this country could not be in the condition in which they are were it not for the exercise of the principles and practice recommended by this association.

After the past presidents had made brief remarks, the President continued:

I think no one knows better than I do E. H. Fritch's ability in taking care of the work of this association. I belong to a number of technical societies and I know of none in which the amount of work is accomplished with such a small force as is found in our office in Chicago, but it is a force, and that force is E. H. Fritch. There is just one fault that he has. He is too modest. During a convention of this kind the tax upon the mental faculties of the incumbent of an office like that is very severe. We have had our experience with Mr. Fritch and he has never failed yet, but I think at the present time he has just about gone through all he can and I am going to

suggest to our Board of Direction, at its first meeting, that we give Mr. Fritch a little leave of absence to get up good, robust health. He is painstaking in the highest degree, and in regard to his work you have only got to point to the volume of Proceedings and the excellent manner in which it is gotten up. Mr. Fritch's early training, of course, helps him to a large extent. I have much pleasure in asking the association to testify their appreciation of their secretary's work by a good, rousing cheer.

At 4:30 p. m. President Taft arrived at the meeting.

President McNab spoke as follows:

In the name and in behalf of the officers and members of the American Railway Engineering and Maintenance of Way Association, it is my pleasing duty, as well as privilege, to extend to you a hearty welcome to our eleventh annual convention, and may I be permitted to say that your visit is none the less appreciated by reason of its informality.

I am quite aware that the objects of this body are as familiar to you as they are to those who have the immediate direction of the location, construction, operation and maintenance of railways. Let me trust that it will not be looked upon as being beyond the limits of modesty, if it be said by me, that the excellence of the physical status of our great trunk lines, as well as that of most of our roads, has not been produced merely by the amount of money expended upon it. It is due also to the manner in which the work involving such expenditure was made, and this has been brought about largely through the influence of and exercise of the principles and practice recommended by this association.

Mr. President, this association is American in name and domiciled in the city of Chicago, yet as far as the science of railroading (in its broad sense) is concerned, it is not circumscribed by mere national lines. Today its chief executive officer is one who is not a citizen of the United States, and on that account he would be deficient of ordinary human nature did he not feel and appreciate in the highest degree the unique honor and privilege he possesses at the present time of presenting the President of the United States of America to this convention, with a request for a few words from your Excellency.

President Taft then addressed the audience as follows:

Mr. Chairman, and gentlemen of the Maintenance of Way convention, I am very glad to meet and cultivate the good graces of a Canadian just at this time. (Applause.) I suppose that I shall surprise you if I tell you that I have done a good deal in the way of railway repair and railway construction. There was a time, between 1893 and 1900, when I occupied the position of United States Circuit Judge in that part of the country where most of the railways went into the hands of receivers—(laughter)—and if you know anything about receiverships, as I doubt not most of you do, as you are railway men—the first thing that a good receiver does is to consult his maintenance of way man and his engineer to see how much in the way of receiver's certificates he ought to issue to make the road safe for the carriage of passengers. I was an undertaker in the burial of I don't know how many railway companies in the Sixth Circuit and in the reconstruction, under the system of receiver's certificates, of thousands of miles of railway, and at that time I was able to follow with a good deal of interest the price of steel rails and how far a million dollars would go in helping along a railway that needed new steel. I came then to know what I ought to know anyway, that the maintenance of way man is the man, after all, into whose keeping is given the safety of ninety millions of people. The engineers who make the roadbed and direct the laying of the track and the building of the bridges are the persons who affect not only our comfort as we go over the road but our safety, and make the question whether we will return to our wives a certain one or otherwise. I traveled 14,000 miles this year and I am bound to say that the travel was in every respect delightful. The ways were well maintained and when we had a jolt we attributed it, not to the engineer of the road, but, knowing something about those things, to the carelessness of the locomotive engineer. (Applause.) But I did not come, gentlemen, to make a speech on the subject of railways. I know that I am looking into the faces of the men who have the brains used in railway construction of this country, and I am glad to be here and to extend you a congratulatory word on the improvement that has gone on in railway construction and railway repair and railway roadbeds within the memory of the youngest of us. So that today you who can look back a generation can see an improvement that you certainly did not expect when you began your profession. We have not, in this country, followed you in the perfection of laws that shall protect the public against accident. I mean not the traveling public, because I think there the statistics are not so unfavorable and compare well with foreign railways, but the law I refer to is the law which keeps the roadbed free from trespassers (applause) and which requires gateways and such protection against the negligence of the public itself as to reduce to a minimum the killing and wounding of people, who, when they are wounded, have only themselves to blame. (Applause.)

Gentlemen, I do not know whether this is the fifth or sixth speech that I have attempted to make today, but I know you will excuse me from saying anything further than to express my great pleasure at your welcome and especially at the hands of one who comes from our Northern neighbor. (Applause.)

The President: We will now take up again the report of the Committee on Signs, Fences and Crossings.

Mr. Williams: We would like some discussion on the subject of flangeway.

Mr. Lindsay: The New York Central has in Utica, N. Y., a double-track line two miles long running on a street paved with granite, on which we used the construction shown on Plate 1 of the report. We have replaced it with 9-in. girder rail, with a rolled flange, setting on ties located on the orginal gravel ballast. The ties are held apart by concrete at the top of the tie. We have maintained a perfect alinement so far.

Mr. Churchill: I have used the chair construction in paved street in Norfolk, Va. The first form we used were short chairs, made wider than the rail flange. Later we lengthened the chairs out and have ties the size of the base of the rail, and since that time we have had no trouble.

Mr. Kittredge: The New York Central has experienced no trouble with the flangeway breaking down. The trouble was simply in the construction of the chairs.

R. N. Begien (B. & O.): In the plans for the small drain there is 12 in. of ballast under the tie, and the track is drained by a 6-in. porous tile drain. I think it is worth while to put in cast iron pipe between the tracks, and have no pipe as small as 6 inches. I put them in as large as 18 inches.

K. J. C. Zink (G. T. P.): How do you expect to get water into the cast iron pipe?

Mr. Begien: We run the pipes inside manholes, practically head walls, and lift them up on the sides; run the tie in through the concrete and pack in between these small head walls with crushed stone.

Mr. Stein: These specifications do not confine you to 6-in. pipe. The report says that pipe not less than 6 in. in diameter shall be used.

C. W. Boynton (Univ Port. Cement Co.): I think it is a mistake to specify porous tile.

Mr. Williams: These plans were gotten up hurriedly, and after the specifications were written they were not checked over, perhaps, as closly as they should be. That is why we said in the beginning that we did not want these plans to go in as any part of the proceedings, but merely to develop some discussion.

YARDS AND TERMINALS.*

The subjects assigned were as follows:

(1) Consider revision of Manual; if no changes are recommended, make statement accordingly.

(2) Study further the subjects reported on at the tenth annual convention, with a view of arriving at conclusions that may be of value concerning each.

(3) Prepare and recommend typical designs for hump yards, with special reference to yards where the preponderance of traffic is empty cars, and where the preponderance is loaded cars, both under varying climatic conditions.

(4) Development of mechanical handling as means of promoting rapidity and economy in the handling of freight.

(5) Submit typical track layout for passenger terminal of medium size, both dead end and loop, and analyze graphically the train capacity of the layout.

The committee presents the changes of the Manual in Appendix A.

The committee finds that as the subjects considered last year and reported on at the tenth annual convention were supplementary to those forming the basis of the preceding report, no additional conclusions of value can be presented.

The committee finds that the plans and profiles submitted with its eighth annual report, together with the conclusions bearing thereon, adopted at the ninth annual convention

*From a report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

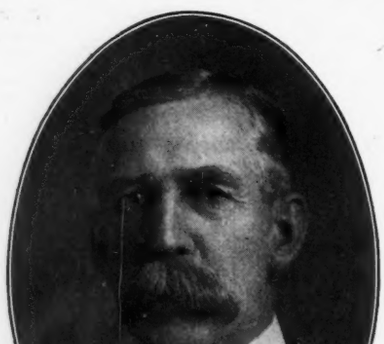
and published in the manual, cover the subject quite fully, particularly as to humps on which scales are located. The committee has not yet secured sufficient data as to relative movement of light and loaded cars over certain grades to be able to present any additional information of value at this time. It is to be noted, however, that the committee's ninth annual report (1909) discussed the operation of hump yards, and gave details of the operation of 28 such yards.

The fourth subject has received a great deal of attention from the committee, and several reports have been made, giving all information obtainable at the time. In Appendix B is given a description of suggested developments in this direction.

The fifth subject has been considered by the committee and much information has been collected as to installation and operation of many stations and terminals of the character named in our instructions. This is given in Appendices C, D and E, but the committee has not yet sufficient data to enable it to make a proper analysis or draw definite conclusions.

The report then discusses briefly double-deck and loop terminals.

The committee's eighth report (1908) suggested a special design of track scale for heavy service in which the dead rail is supported on a continuous concrete wall instead of on iron standards. This construction has been carried into effect for a scale 39 ft. 2 in. long, and of 120 tons



F. S. STEVENS.
Chairman Committee on Yards and Terminals.

capacity, at Coatesville, Pa., on the Philadelphia & Reading. The Pittsburg & Lake Erie has installed a track scale of 200 tons capacity, designed to weigh cars passing over the scale at a speed of five miles an hour. It is fitted with an automatic weighing device. A feature of the scale is that the end is so arranged that, instead of the entire load being taken by the end section, it is distributed, the wheel on one side loading the first section, while the wheel on the other side loads the second section. This reduces the stresses due to the sudden application of the load. The platform is 67 ft. long, with an effective length of 53 ft.

The following recommendations were adopted at a committee meeting, but were reconsidered later. It was decided that further discussion and a consideration of the plans accompanying the report might make it advisable to make changes. They are given herewith as a matter of record and as information, but not as a part of the report.

(1) In planning the track arrangement for a passenger terminal, each platform track should be connected (as near the end of the platform as is practicable) with at least two lead or approach tracks. These latter, in turn, should be connected with as many platform tracks as practicable, up to the limit required in each instance. The purpose of this is to permit departing and arriving trains to meet or pass immediately outside the platform, and also to provide the maximum number of independent drilling or switching routes.

(2) Where platforms between tracks are to be used for passengers and trucking, the distance between centers of tracks should be not less than 28 ft. if posts are located on the platform, and not less than 24 ft. if there are no posts.

(3) Platforms should be covered. When a train shed is used it should be formed by a series of short transverse spans, each to cover not more than two tracks and a platform. This type of train shed is recommended as permitting good ventilation and light, and involving a low cost of maintenance.

The report is signed by: F. S. Stevens (P. & R.), chairman; E. E. R. Tratman (Engineering News), vice-chairman; Hadley Baldwin (C., C., C. & St. L.), W. C. Barrett (B. & O.), G. H. Burgess (D. & H.), L. G. Curtis (B. & O.), A. H. Dakin, Jr. (Consulting Engineer), H. T. Douglas, Jr. (W. & L. E.), A. C. Everham (Detroit River Tunnel), M. J. Henoch (L. & N.), H. A. Lane (B. & O.), B. H. Mann (Mo. Pac.), L. J. McIntyre (Nor. Pac.), A. Montzheimer (Elgin, Joliet & Eastern), G. F. Morse (Cent. of N. J.), W. L. Seddon (S. A. L.), C. S. Sims (D. & H.), C. H. Spencer (Washington Terminal), C. H. Stein (Cent. of N. J.) and A. Swartz (Erie).

Appendix A.

Definitions for Yards and Terminals.

The proposed changes are as follows:

Terminal.—An assemblage of facilities provided by a railway at a terminus or at intermediate points on its line for the purpose of assembling, breaking up and relaying trains.

Yard.—A system of tracks within defined limits provided for making up trains, storing cars and other purposes, over which movements not authorized by time table or by train order may be made, subject to prescribed signals and regulations.

Receiving Yard.—A yard for receiving trains.

Separating Yard.—(Eliminate.)

Classification Yard.—A yard in which cars are classified or grouped in accordance with requirements.

Cluster or General Yard.—(Eliminate.)

Gravity Yard.—A yard in which the classification of cars is accomplished by gravity.

Poling Yard.—A yard in which the movement of cars is accomplished by the use of a pole operated by an engine on an adjacent parallel track.

Summit or Hump Yard.—A yard in which the movement of cars is accomplished by pushing them over a summit, beyond which they run by gravity.

Tracks:

Body Track.—Each of the parallel tracks of a yard, upon which cars are switched or stored.

Ladder Track.—A track connecting successively the body tracks of a yard.

Lead Track.—An extended track connecting either end of a yard with the main track.

Open Track.—(Eliminate.)

Running Track.—A track reserved for movements through a yard.

Relief Track.—An extended siding long enough to allow an inferior train to continue running.

Stub Track.—A track connected with another at one end only.

Spur Track.—A stub track of indefinite length diverging from main line.

House Track.—A track alongside of (or entering) a freight house, and used for cars receiving or delivering freight at the house.

Industrial Track.—A track serving one or more industries.

Team Track.—A track where freight is transferred direct between cars and wagons.

Note.—In a typical yard there will be several tracks devoted to special purposes, varying with local conditions. These will include caboose tracks, scale tracks, coaling tracks, ashpit tracks, bad order tracks, repair tracks, icing tracks, feed tracks, stock tracks, transfer tracks, sand tracks, depressed tracks, etc.

Switching District.—(Eliminate.)

Rail and Water Terminal.—A terminal where freight is transferred between railway cars and boats.

Wye.—A triangular arrangement of tracks used for turning engines, cars or trains.

Transfer Slip.—A protected landing place for car floats with adjustable apron or bridge for connecting the tracks on the land with those on car float.

Incline.—An inclined track (or tracks) on a river bank at a protected landing place, with adjustable apron and

cradle for connecting to the track on a car float for transfer of cars.

Siding.—A track auxiliary to main track for meeting or passing trains, limited to the distance between two adjacent stations.

Passing Siding.—(Eliminate, and use definition of siding.)

Lighterage Pier.—An open or covered pier at which freight is transferred directly between cars and boats.

Station Pier.—A pier having no rail connections, where freight is received and delivered by car floats.

Recommended Practice.

Body Tracks.—Under ordinary conditions body tracks should be spaced 12 ft. to 13 ft., c. to c., and where they are parallel to main track or other important running track, the first body track should be spaced not less than 15 ft., c. to c., from such main or other important track.

Ladder Tracks.—These should be spaced not less than 15 ft., c. to c., from any parallel track. Frogs of greater angle than No. 8 should not be generally used, and the angle between the ladder track and body tracks will be governed by the distance on ladder track required for a turnout.

Lead Tracks.—For safety of operation the connections of these tracks with the main track should be interlocked, and to facilitate train movements, communication by telegraph or telephone should be established.

Drill Tracks.—Drill tracks should be so located as to cause least possible interference with other movements.

Open Tracks.—(Eliminate.)

Running Tracks.—Running tracks should be provided for movements in either direction, to enable yard engines to pass freely from one portion of the yard to the other; also to enable road and yard engines to pass to and from the engine house and other points where facilities are provided.

Caboose Tracks.—Where conditions permit, caboose tracks should be so located that cabooses can be placed on them in the order of their arrival, and should be so constructed that cabooses can be dropped by gravity onto the rear of departing trains.

Scale Tracks.—Scale tracks should be so located that weighing can be done with least delay; and where many cars are to be weighed they should pass over the scale by gravity and be weighed while in motion.

Bad Order Tracks.—Where cars are classified, one or more classification tracks, easy of access, should be provided for setting off cars in bad order, from which they may be readily removed to the repair tracks.

Icing Tracks.—Icing tracks should be so located that the work of shifting out, icing and classifying cars for movement can be performed in least time.

Yard.—If possible to so arrange, the main tracks of both single and double-track roads should be located on the outside of yard, and engine house, coaling station, etc., should be centrally located.

Coach-Cleaning Yard.—The coach-cleaning yard should be conveniently located near terminal station. The tracks should be of sufficient length to hold full trains, and should be stub ended, with a car cleaner's repair and supply building at right angles thereto at their ends.

Inbound Freight House.—Inbound freight house should be of such width as will furnish a reasonable amount of floor space for holding freight (5 ft. is a good average width). Usually not more than two tracks are needed, and the side toward the tracks should be provided with a platform and should be fitted with doors moving vertically between the posts to avoid the necessity for spotting cars.

Outbound Freight House.—To avoid excessive trucking, the outbound freight house should be narrow (25 ft. is a good average width), and not more than four tracks should be provided. The side toward the tracks should have a platform and should be fitted with doors moving vertically between the posts.

Where a great number of cars are required, the average trucking distance will usually diminish and trucking through cars will be avoided if the freight house is built at right angles to and at the back ends of a series of stub tracks built in pairs, with covered platforms between.

Transfer Station.—A transfer station should be located at a point where traffic is concentrated, and where a necessity exists for consolidating freight into a less number of cars for movement to a certain destination, or for separating and reloading freight into a greater number of cars for further movement to final delivery.

Yard at Rail and Water Terminals.—The tracks should be so arranged that as trains arrive the cars can be promptly classified and grouped for delivery without interference with other movements.

Piers.—At rail and water terminals the piers should be designed with a view to the most efficient, rapid and economical handling of the business, and with a view to its future development. Care must be, etc.

Grain Elevators.—If conditions permit, grain elevators should be so located that cars may be put in at one end and taken out at the other, and without interference with other yard movements. Where this cannot be done the tracks should be so arranged that the work of placing and removing cars may be done without serious interference with the operation of the elevator or delay to other shifting.

Car Capacity of Freight Tracks.—It is recommended that 42 ft. per car be allowed in rating the car capacity of freight tracks.

(1) Freight car repair yards should be composed of short tracks of about 15 cars capacity, arranged in pairs; each pair should be spaced 15 ft., c. to c. of tracks, and the pairs should be spaced 40 ft., c. to c. of pairs.

(3) In computing working capacity of repair tracks, 50 ft. should be allowed for each car.

(4) The yard should be equipped with air and water pipes, and outlets furnished with air hose should be provided at intervals of 50 ft. for testing the brakes on cars.

(5) Tracks on which heavy repairs to freight cars are made should be under cover, and overhead traveling cranes should be provided for heavy lifting.

Team Delivery Yard.—(2) The tracks should be stub tracks, arranged in pairs, spaced 12 ft., c. to c., and if conditions permit the pairs should be spaced not less than 52 ft., c. to c. of pairs, or 30 ft. in clear. For convenience in handling, the tracks should not exceed 20 cars capacity each.

(3) If possible, the yard should be provided with a power-driven crane for handling heavy freight.

(5) Wagon scales should be installed at most convenient place near the entrance to the driveway, and a track scale should be placed at the most convenient location for weighing cars when entering or leaving the yard.

Hump Yards.—(10) Where cars to be classified are largely empty or light, and the scale is on the hump, grades are recommended for average conditions, as follows.

The summit of the hump should be reached from the ascending grade by vertical curves, etc.

Discussion on Yards and Terminals.

F. S. Stevens (P. & R.): The first item of our instructions was to consider the revision of the Manual, and this constitutes the principal part of the report presented at this time, and we will ask you to adopt the present form for substitution in the Manual. The second item is to study further the subjects reported on at the tenth annual convention, which was a supplement to the preceding report, covering practically nothing else. Being a supplemental report, it did not, in the opinion of the committee, require any additional conclusions. Therefore, we considered that portion of the instructions covered also. The third instruction is to prepare and recommend typical designs for hump yards. This subject, we consider, we have covered quite thoroughly from time to time, and since the original report was made we have brought the matter up to date. Since the last report treating on that subject there has been no new developments and nothing has been discovered by this committee to add to the report previously made. The fourth item of our instructions was the development of mechanical handling as a means of promoting rapidity and economy in the handling of freight. This is a subject that we have considered every year for some time. We are still keeping up with the advance made on this subject, and present what we have been able to obtain this year, with the request that these instructions be continued. The fifth instruction was on the subject of typical track layout for passenger terminals of medium size. We have collected a large amount of data on which to work. We submit, therefore, the matter connected with the fourth and fifth paragraphs of our instructions, as a progress report only. We will ask you to adopt our recommendations, in their amended form, for the Manual.

L. G. Curtis (B. & O.): As a member of the committee I want to make a suggestion under the heading of "Transfer Station." While I think the matter is covered very nicely for ordinary stations, for terminal points like Chicago we ought to incorporate after the word "cars" in the third line of the matter at the top of page 147 the words "or into home cars." The definition as given there is not just as plain as it should be, and does not cover

every transfer station, for the reason that cars are often transferred in order to get the lading into home cars, and I simply make that suggestion. I will put that in the form of a motion.

Mr. Meade: Why not make those words "system cars?"

Mr. Curtis: That will be satisfactory.

Mr. Stevens: The committee will accept that.

Mr. Cushing: On page 143, under "Ladder Tracks," the committee recommends a change from No. 7 frogs to No. 8 frogs for yards. I do not like that. I move that it be left No. 7, as at present.

Mr. Nelson: I hope the motion will not prevail. Those who experience the trouble that we have with long coupled engines on short turnout curves will be glad to see No. 8 frog adopted.

Mr. Cushing: We have as long coupled engines as anybody.

Mr. Nelson: Some roads also have a long push.

Mr. Courtenay: The L. & N. also had trouble with No. 7 frogs in the turnouts. On account of that trouble we have gone to No. 8.

Mr. Wendt: I would like the committee to explain why that change was made.

Mr. Stevens: The clause reads: "Frogs of greater angle than No. 8 should not be generally used, and the angle between the ladder track and body tracks will be governed by the distance on ladder track required for turnout." The object of that is to secure the greatest possible radius of turnout with the greatest possible angle between the turnout and the body track. To illustrate that point, I will say that I have under construction now some turnouts with No. 8 frogs, in which the angle between the ladder track and body track is 9 deg. 10 min. That places the switch close to the heel of the frog in each case, and makes use of the entire distance on the ladder tracks for turnouts with no waste room. The object is to secure a larger radius than you can secure with a No. 7 frog, but the same object is secured in so far as the angle is secured. The same economy is secured as would be secured with the No. 7 frog. We thought this was a better arrangement than to use the No. 7 frog on that account, and that the radius of curvature is easier.

The conclusions of the committee were adopted.

Concluding Business of the Convention.

W. L. Seddon (S. A. L.): Under the head of new business I have a matter to bring before the association. I do not know that any of my railway friends are having the experiences we are having down in the southeastern section of this country regarding the requirements for structures over navigable streams. The definitions of navigable streams have been very much extended in the last few years, and under the present situation, while the matter is left somewhat in the discretion of the United States engineering officer of the district, it is very often in such shape as to put him in a rather awkward position, and I believe the time is ripe for something to be done on that line. I have talked to several army officers about the matter and I believe if this association would appoint a committee to confer with the Chief of Engineers, considerable help could be had for the railways in that respect and one that we need very much in my part of the country where the small motor boat is causing us to put in very expensive structures on streams with no other navigation.

The President: The board of direction will take that matter under consideration.

Gentlemen, I have very much pleasure in presenting to you L. C. Fritch, whom you have elected as your president for the ensuing year. I will ask Mr. Wendt and Mr. Cushing to escort Mr. Fritch to the chair. (Great applause.)

Mr. Fritch: I appreciate very deeply, gentlemen of the association, the honor you have conferred upon me. I am following a long line of illustrious predecessors who have brought this association up from its humble beginning until I think it is now the strongest railway association in the United States, in fact in this country today. I sometimes think that the membership at large and the railway managers and executives do not appreciate what this association is doing for the railways. I believe that the recommended practices of this association are saving the railroads of this country thousands, perhaps millions of dollars annually.

My only hope, gentlemen, is that I may fill the duties of this office to the satisfaction of the association. I know that with the coöperation of the board of directors, the officers, the committees and the membership at large and with my own effort, I will render to the association the very best that is in me. I thank you. (Applause.)

President Fritch: Gentlemen of the convention, I beg leave to offer a resolution of thanks of this association to our retiring president, William McNab. He has given the association almost two years of untiring effort as the guiding hand of this organization. You might say that most of the success of this association is due to the efforts of the president. It is the executive officer who is in charge of the destinies of the association, and its success is proportioned to the amount of zeal and energy that he puts into the work. I think that this convention marks the very zenith of the success of this association, and I think it is largely due to the efforts of our retiring president. I want to ask you all to rise in a vote of thanks for our retiring president.

The members rose and cheered the ex-president.

Mr. McNab: Mr. President and Gentlemen: Just let me say this: I appreciate the vote of thanks you have passed, and all I want to say now, which I could not say during my term of office, is that the office of president of this association is not a sinecure.

Mr. Coates: I desire to offer a resolution of thanks to the Irish Fellowship Club of Chicago for the assistance they gave us in securing the attendance of the President of the United States at this meeting.

President Fritch: I think the resolution is happily put, for the reason that credit is largely due to the local committee of the Irish Fellowship Society for having the President with us today.

The motion of Mr. Fritch was put and carried.

Mr. Ewing: I desire to add to the resolution I put a little while ago and to thank the committee of arrangements in the part they took in getting the President to come here.

The President: If there is no objection, the entire Committee of Arrangements will be included in that arrangement.

Mr. McDonald: I move that we adjourn.

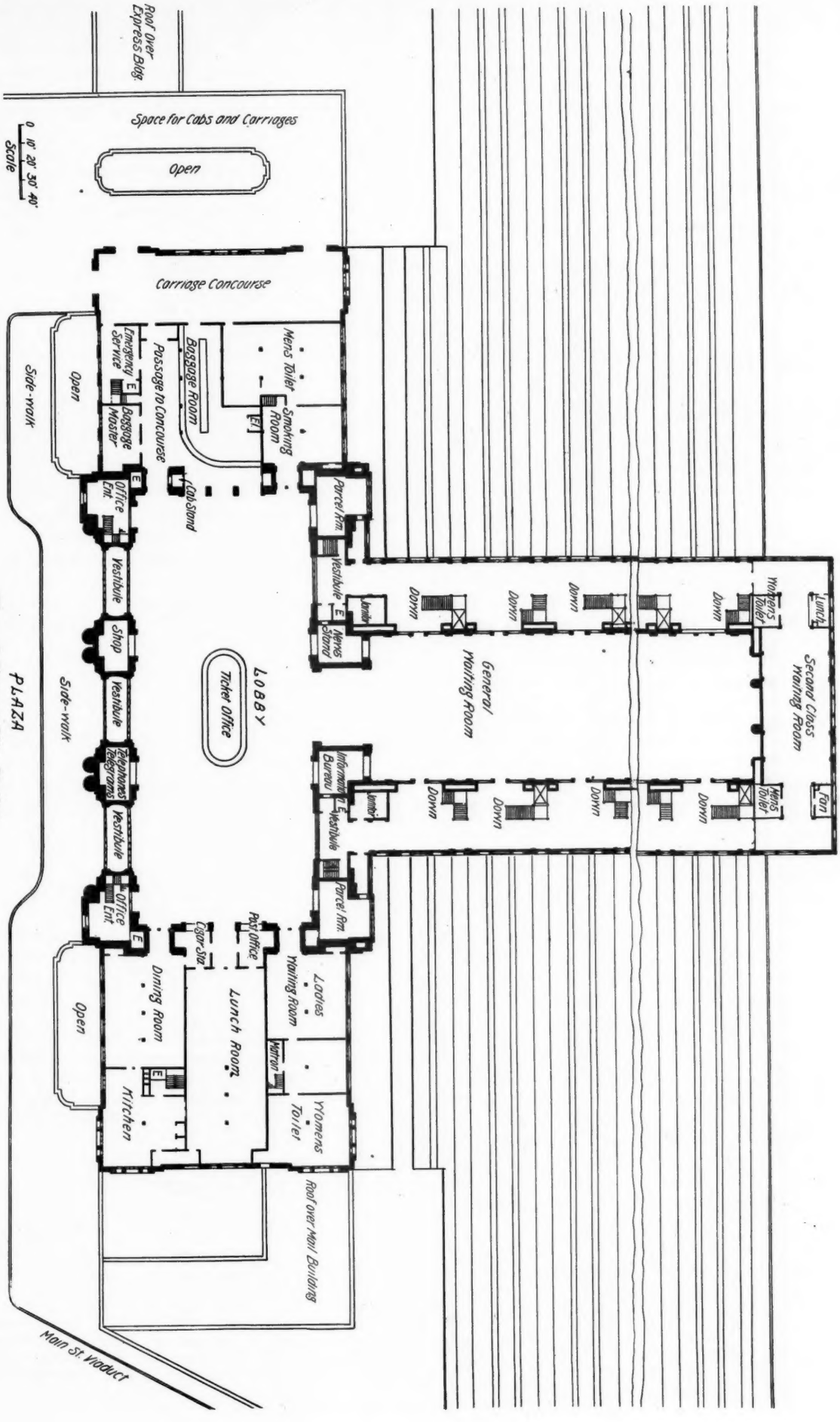
The President: I now declare the eleventh annual convention of the American Railway Engineering and Maintenance of Way Association formally adjourned.

KANSAS CITY UNION PASSENGER STATION.

The accompanying plans show the proposed union passenger station at Kansas City, to be built by the Kansas City Terminal Railway Company. This station is a part of the scheme of terminal improvements approved by the city council and ratified by referendum vote last September (see Railroad Age Gazette, November 19, 1909, page 963). The plans shown herewith have been approved by the board of directors of the terminal railway. Certain minor modifications are now being worked out by Jarvis Hunt, Chicago, the architect who designed the station.

The present union station at Ninth street serves the ten roads, who own the stock of the Terminal Company, as follows: The Chicago, Rock Island & Pacific, the Atchison, Topeka & Santa Fe, the Wabash, the Missouri Pacific, the Union Pacific, the Chicago, Milwaukee & St. Paul, the St. Louis & San Francisco, the Chicago, Burlington & Quincy, the Chicago & Alton and the Missouri, Kansas & Texas. The new union station will be at Twenty-second street, between Main street and Broadway. It will take care of the above roads and four more which now use the Grand Central depot, namely, the Kansas City Southern and its three tenants, the Chicago Great Western, the St. Joseph & Grand Island and the Quincy, Omaha & Kansas City.

As shown on the small scale plan, the new station is a through station. Most of the roads in it run trains through Kansas City, but for several it will be a terminal, either eastern or western, and on the others there will be many local trains originating or terminating here. It was first designed for 12 station tracks and two running tracks, based on the service required in the present union depot. A study of the present traffic of the additional four roads, however, together with an estimate of the increased traffic which must be taken care of by the time the station is completed, made it evident that 16 station tracks would be required, and these, with the two running tracks, are to be

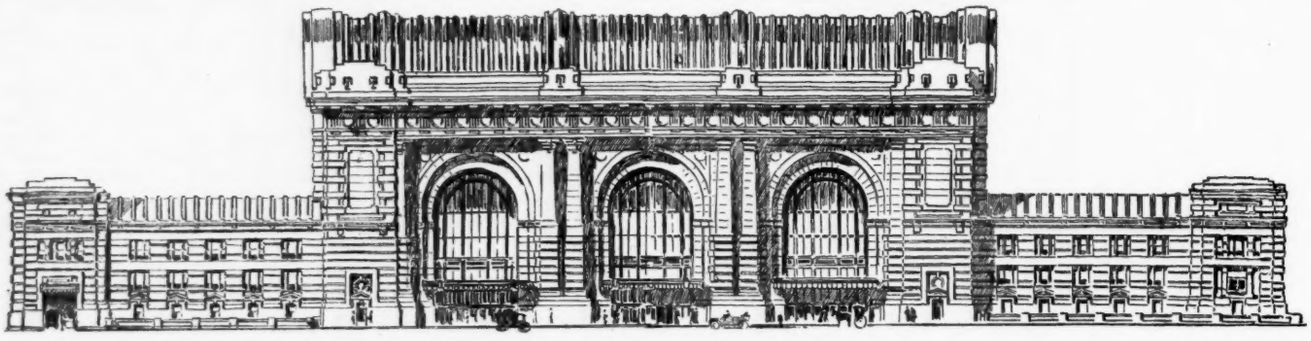

Roof over Express Bldg.
Space for Cabs and Carriages
Open
Scale 0 10' 20' 30' 40'
Carriage Concourse
Mens Toilet
Smoking Room
Baggage Room
Passage to Concourse
Emergency Service
Baggage Master
Side-walk
Open
Cab Stand
Parcel Rm.
Vestibule
Office Ent.
Vestibule
Shop
Vestibule
Telephones Telegrams
Vestibule
Office Ent.
LOBBY
Ticket office
Side-walk
PLAZA
Plan of Kansas City Station.
Information Bureau
Vestibule
Parcel Rm.
Post Office
Cigar Stn.
Dining Room
Kitchen
Lunch Room
Ladies Waiting Room
Mirror
Womens Toilet
Roof over Mail Building
Main St. Viaduct
Mens Toilet
Mens Stand
General Waiting Room
Second Class Waiting Room
Womens Toilet
Lunch
Fan
Down

built now. The company owns enough land to add six more tracks when they are needed.

The present union station handles, per day, 212 trains, made up of 1,100 cars, making a daily average of 20,000 passengers using the station. The present Grand Central station, serving the Kansas City Southern and its tenants, handles 22 trains per day. It is estimated that in 1915 the new station will take care of 317 trains and 48,000 passengers daily. It is on this estimate that the present lay-out of tracks is based.

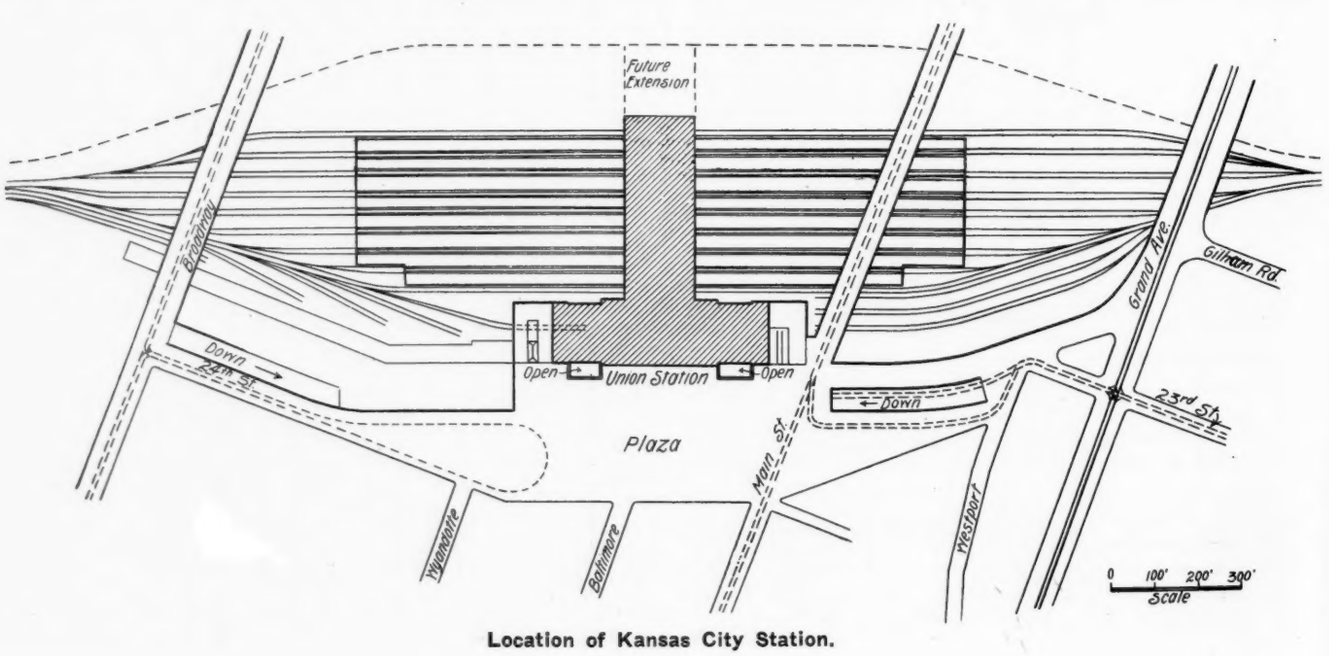
The provisions of the city ordinance required the company to buy land and make a plaza in front of the station. As shown, the station fronts to the south, facing toward the residential portion of the city, the business district being to the north of the tracks. This frontage is desirable as making a better appearance when the property around the plaza is developed. The land to the north of the tracks would have been much more expensive and the outlook would have been on the unattractive wholesale district. The plans show proposed street car lines coming across on the Main street and the Broadway viaducts, and also a loop from Broadway down to the plaza. No such lines have been built nor has anything definite been decided on regarding them. The new viaduct carrying Main street across the tracks is nearly completed, and street cars are now in operation on the Grand avenue viaduct. The plaza is on the same level as the Main street viaduct and the proposed Broadway viaduct and about 10 ft. below the level of Grand avenue. The present yards are already depressed, but considerable excavation will be necessary for the station building. As indicated on the plan, inclines will lead down from Broadway and Grand avenue to the lower or track level of the station, so that teams can go direct to the baggage, express and mail rooms without getting on the plaza.

The purpose of the plaza is not only to make the station approach more dignified and attractive, but also to facilitate the handling of passengers. In mild weather the plaza area supplements the waiting room area, thus increasing the capacity of the station at a cost much lower than the cost of a roofed over structure. Also it will reduce the congestion at the entrance of the station. Where the station fronts on a street, passengers leaving the station have to turn directly to the right or to the left and interfere with incoming passengers restricted to the same lines of movement. When the entrance is on a broad plaza, passengers diverge in all directions as they leave the entrance and, similarly, the entrances are approached from all directions, and the movement is more free.



Kansas City Union Passenger Station.

The large scale plan of the concourse level shows the lay-out of facilities. These, as indicated above, will be modified to some extent. The general waiting room is directly over the tracks. Each pair of tracks is served by ramps and an elevator, and perhaps escalators will also be used. The plan herewith shows stairways, but these plans, as indicated, will be modified when it is decided exactly what connections there will be between the waiting room and the track levels. Incoming and outgoing passengers are kept entirely separate; passengers leaving the trains will use the side galleries or midways, and travelers bound to trains will



Location of Kansas City Station.

use only the central waiting room. Tickets will be examined at the entrances to elevators, ramps, etc., so that the passenger cannot help but go direct to the proper platform.

The platform sheds will be of steel, concrete and glass construction, but the exact design has not yet been decided. On the track level floor of the station building are the mail, express and baggage rooms, commission and Pullman service and the despatcher's office. From this floor there are elevators and a baggage chute to the sub-basement from which baggage, etc., is delivered to the station platforms through subways. Electric baggage trucks will be used throughout. They are similar to those in service at certain points on the Pennsylvania Railroad, but an improvement has been made on this design, namely, the floor of the truck can be tilted so that baggage slides off into the baggage chute, thus doing away with a certain amount of handling.

The upper stories of the wings of the building will be used for offices. The station will be built of steel, stone and concrete, and the interior finishing will be marble. Over the lobby, as indicated in the front elevation, is an arch roof, with axis parallel to the tracks.

Under the original ordinance, the company proposed to spend $3,000,000 for the passenger station, but the present plans require an expenditure of $5,750,000, exclusive of real estate. The company asked for vacations of streets on February 4. Under the city ordinances the City Council will be able to act March 30 and, judging from the sentiment of the council and the attitude of the citizens, as indicated by the overwhelming vote in favor of the terminal ordinance last fall, there is little doubt but that the street vacations will be granted at that time. The Terminal Company has bought all the property required and is ready to let contracts as soon as the council acts. It is expected to have the station open in 1913.

We are indebted to H. L. Harmon, president of the Kansas City Terminal Railway, for material for the above description.

The railway branching off the Peking-Hankow line at the small station of Chentow, several miles to the south of Chentingfu, traverses the hilly country to the west, and terminates at Taiyuanfu, the provincial capital of Shansi. Its official Chinese name is the Chen-Tai Railway, but it is also as well known by the name of the Shansi Railway or by its French translation "Ligne du Chanse." This line of 150 miles in length was probably the most difficult to construct of any of the roads in the Chinese Empire. Traversing a very mountainous country, the line has steep gradients, many curves and long tunnels. The highest point reached in the line is 3,500 feet above sea level, and at its western terminus at Taivuanfu the elevation is 2,600 feet. The air line distance between Chentow and Taiyuanfu is 120 miles; by the railway it is 150. There are 25 stations on the line, a somewhat larger average than found on the main Peking-Hankow road.

A CORRECTION.

By courtesy of Henry M. Sperry we are enabled to straighten out herewith a portion of Monday's discussion that got a little tangled (Railway Age Gazette, March 15, page 575):

W. K. Howe (General Railway Signal Company): I am in harmony with a great deal that Mr. Rae has said. There are, however, some things in his paper to which I must take exception. On page 49 of the proceedings he makes the following statement: "As seen above the current required to operate single-phase motors is excessive," etc. As a matter of fact, motors are now available which will operate on single phase in which both the starting current and torque are no greater than when running. They take even less current to start then do three-phase motors. I therefore take it that Mr. Rae's remarks apply to single-phase induction motors.

The single-phase motors I refer to as taking so little current are very high in efficiency and have no teaser windings, centrifugal starting contacts, etc. With this motor the entire system can be started without as much current as would be required with three-phase motors.

Mr. Rae states that single-phase generators require more material, etc., for the same output. This is true, but is an insignificant point, because the added expense required for a single-phase generator which will start the entire system without excessive drop is so small that it is hardly worth considering.

Regarding the matter of sectionalization, I believe it to be good practice to sectionalize at substations where the cost would not be prohibitive. That is, one substation would feed all the way to the adjacent substation normally, so that if a break should occur the adjacent station could take over the portion of the line thus isolated.

Conventionalities

W. H. Taft, president of the United States, was in town yesterday.

The committeemen who were provided with yellow badges felt that the world was all against them on Thursday—St. Patrick's day.

Good as the attendance at the convention has been all along, it was remarkable to notice the interest that was shown at the closing session when attendance is apt to be a little slack. Mr. Taft—he was to speak.

It is an interesting fact that the word gazette, used so much to-day as the name of publications, is the result of an act of a public-spirited citizen in Venice in the fourteenth century. In booths on the street, this gentleman posted news bulletins, and admission to the booth was gotten upon the payment of one gazette, a small coin used at that time.

As an indication of the value of exhibits at a convention of the character of the present, it may be worth while to note that twelve inspectors employed by R. W. Hunt & Co. were assembled in a body on Thursday afternoon, under the leadership of C. W. Gennet, Jr., from the local office, for the purpose of inspecting the track and maintenance of way appliances at the Coliseum.

Merely to help out the professional talent and to assist in making a record for an association in which he has only an altruistic and educational interest, Dr. W. F. M. Goss spent one day with the convention. It is unfortunate for this association that it does not deal to any great extent in the subjects with which Dr. Goss is directly concerned in his educational work, of which the railway mechanical associations are so largely the beneficiaries in June of each year. As colleagues at Purdue Professors Goss and Pence worked side by side with no perceptible interference, and with the innate modesty so characteristic of the man, Dr. Goss is quite content to assume an inconspicuous part in an association upon whose published literature Pro. Pence's work makes so deep an impression.

Inadvertently, Frank R. Coates was mentioned as the president of the Interocean Steel Company. Of course, the curse of our error was removed by the fact that we gave him a higher office than he actually holds. He is vice-president. The baneful effects of the error were possibly thrown further into perspective by our very complimentary and courteous reference to the fountain of perpetual youth from which Frank absorbs. It is only fair to extend all the courtesies there are to him and the rest of the committee on arrangements—W. A. Wallace, chairman, J. B. Cox, who, if memory serves, has done the

same stunt at every meeting of the association, L. C. Fritch, who had time because the nominating committee had treated him right, and John C. Lesser and O. J. West. It is not known exactly what each individual of the committee did, but their team work resulted admirably. There has not been a flaw of any kind in the work of the committee of arrangements.

Since there were several more or less painful accidents in the handling and demonstration of the many appliances on exhibition at the Coliseum, the Railway Appliances Association arranged with the local Illinois American Red Cross for the services of six of its members. Several cases have so far been given the first aid to the injured treatment. Space has been reserved at the right of the main entrance, where the Red Cross members are equipped to answer any and all calls.

THURSDAY'S NIGHT THOUGHTS.

Same old subjects—
Speakers, too;
Same conclusions,
Nothing new.
Heaps of papers—
Dry as dust—
By committees
'Cause they must.

Same exhibits
Here once more;
Windy salesmen—
Talk galore;
Bragging speeches—
Stories, too—
Same old stories,
Nothing new.

Tired of list'ning,
Going to go;
Leave the smoky
Chicago.
Hope they'll like it—
Wouldn't be 'em—
Clearing out the
Coliseum.

MR. HOOLEY ON SIGNALING.

"The' was a convintion av th' signal min at th' Congriss Hot'l doorin' th' week, 's I rade in the pa-apers," remarked Mr. Hooley, casually, the other morning, to his friend, Mr. Dennissey. "T' me mind, Dinnissey, th' signal man's th' 'riginal saf'ty 'pliance av American relrods. Iv ye have wan man to luk out f'r saf'ty arl 'long th' line, ye'er road's safe. But ye say, Dinnissey, f'r th' signal man to be av anny good, he's got to have th' apparratus t' extind his influence 's far's th' road goes, 'nd 'tis not within th' powers av wan man, 'nless he's a gayraff, Dinnissey, that he c'n ixtind 'imsilf over siv'ral t'ousand miles av rails 'nd ties—slapers, they call thim in Ingland, 'nd 'tis a good rayson f'r carlin' thim something else in this land av th' free discindant av Brine Boroo—ties. I says—iv he can't ixtind himsilf over th' whole line, 't is fate that th' accident occurs just 't th' pla-ace where th' signal man is not at that p'ticular time. 'For thim r'asons,' says me friend Bayylet, 'r wuds t' that iffect—Ballyet 's th' prisidint' av th' Signal 'Sociation—'f'r thim r'asons,' says Ballyet, 'ye can't run a safe road wit'out plinty av signals. Iv ye have to putt signals t' ivery switch,' says Ballyet, says he ' 'tis betther to do so, 'nd to give th' ingineman warnin' av how much comp'ny he's goin' t' have whin he runs by 'nd th' thrain goes in th' ditch wit' th' poshibility th't th' ingin' goes wit' 'em 'nd gives an exybition av high degrays av timp'rachoor before 'tis due be th' schedule that's detarmined be their past lives. D'ye know th' diffrens bechune a simmyfor 'nd a gin'ral maniger, Dinnessey?" inquired Mr. Hooley, interrupting himself.

"I don't know gin'ral manigers, Misther Hooley, 'nd what is a simmyfor?" said Mr. Dennissey.

"I t'ought ye didn't know th' diffrens, Dinnissey. I know a relrod newspa-aper man who sid, when he started his pa-aper, he was in th' same c'ndition av knowin'ness. He learned something fr'm expayrience. Dinnissey, 'nd that's more'n ye'll do av ye don't begin soon. He hilped out his so'rces av inf'mation be publishin' a daily noospaper wanst or twicet a year, whin the' was a relrod convintion like th' wan that serves as me tixt, only th' wasn't anny convintion av that kind in thim days. But t' t'row th' simmyfor in th' upper quadrant, so't avin ye c'n say ut, Dinnissey. D'y knaw, me frind, that whin ut foorst became nicissary f'r relrod trains to be signaled, 'twas th' habit t' do ut wit' th' arrums—wit' a flag 'n th' daytime 'nd a rid lantern be night? Sometimes 't was done wit'out ayther 'nd thin 't was saf'ty f'r th' thrain, but not much f'r th' man that did th' wavin', for by th' goil wit' a rid pitty-coat who always escaped 'nd saved th' thrain besides. Whin, wit' th' 'dvancemint av human knowledge 'nd th' increase 'n mechanical skill, 's me frinds Ellyot 'r Rood 'r A-ames might 'av sid, but didn't, 's far's I know, doorin' th' convintion—whin, I say, 't was nicissary f'r somet'ing to be wurruked in a mechanical way to take the pla-ace av th' human arms which cudn't be waved over siv'ral miles av thrack 'nless th' signalman 'd arrums like th' nick av th' gayraff—whin, I say ut agin, they had t' make signals that'd shtay putt avin iv th' wind was a-blowin' 'nd th' shnow a-shnowin', they made th' signal like ye'er arrum, Dinnissey, 'nd putt a wire to ut, be th' same token, so 't wud wiggle th' way 't they wanted ut to wiggle. Th' thing they putt up there f'r a signal, Dinnissey, was a simmyfor."

"What's th' simmy for?" asked Mr. Dennissey, who had nodded once or twice before Mr. Hooley finished speaking.

"O, Dinnissey, Dinnissey, whin will ye iver learn t' pay attintion t' me illuminatin' remarks," moaned Mr. Hooley. "Th' simmyfor 's th' wooden arrum that's putt up on a post 'nd wit' a wire connected to ut, so 't whin ye pull th' wire th' arrum goes up or down. 'Nd it manes something iv'ry time ut goes up or down. Th' wurrukin' av th' simmyfor, Dinnissey, 's like th' movemint av ye'er arrum whin I say, Wud ye have th' same? They's t'ree p'sitions, Dinnissey. Whin ye reach f'r th' bottle, ye'er arrum's out sthraight. That's danger, Dinnissey. Whin ye raise ye'er arrum half way up, Dinnissey, that manes caution, because ye've prob'ly filled th' glass so full ye may shpill ut. Iv ye was runnin' a thrain ye might mate with an accident av ye didn't pay attintion t' th' indications av th' simmyfor, as ye wud wit' me av ye didn't look at me. Iv th' thrack's clear th' simmyfor 'll go t' th' lasht position, 's ye'er arrum 'll be in whin I give ye th' wink that means 'Prosade.' Th' Dootchmin call ut 'Prosit,' but ye needn't mind that. Whin ye'er arrum's in the 'Prosade' p'sition, ye know what ye c'n can do, Dinnissey."

"D'ye iver give objic lissons, Misther Hooley, t' illusthrate ye'er manin' more complately?" inquired Mr. Dennissey, with some display of interest.

"Me signal app'ratus 's av th' old-fashioned kind, 'nd 'tis not fitted f'r illusthrations av wurruk 'n th' upper quadrant," replied Mr. Hooley, as he doused and wiped the empty glasses.

At the Coliseum

The Vanadium Sales Company of America, Pittsburgh, Pa., has just issued two new publications treating of vanadium steels, their classification, heat treatment and also instructions for application. These booklets are printed, one in German and the other in French, to meet the demand for this information published in foreign languages. Copies of these booklets will gladly be sent to interested parties.

A combination tie plate and guard rail clamp is shown in space 137 by the W. F. Bossert Manufacturing Company, Utica, N. Y., that overcomes the objections heretofore made with regard to a device of this kind. There are no screws to jar loose. It is adjustable to wear. The tie plate and guard rail clamp bind the rails into a firm and solid structure. The semaphore blade clasps, shown by this company, simplify the work of installation and insure a large saving in the cost of maintenance. One, and never more than two bolts are required, instead of six, as at present used.

LITH BOARD.

The cut run with the Union Fibre announcement March 15, should have had the caption "Pacific Fruit Express Ice House, Grand Island, Neb." We located it, erroneously, at Las Vegas, Nev.

UNITY SWITCH STAND.

Among the devices on exhibition by the Morden Frog & Crossing Works, Chicago, in booth 86 at the Coliseum, is the Unity switch stand. This stand operates and interlocks a split switch and distant signal. It is a parallel ground throw stand with a single lever moving through 180 deg., and is provided with an independent facing point lock rod to the switch point. With the switch set and point locked for main line and the distant signal indicating "safety," the first 90 deg. throw of the lever sets the distant signal to "danger" and then releases the point lock, the final 90 deg. of the lever movement throwing the switch. Switch may be thrown back and forth for drilling or switching without disturbing the distant signal, which remains at danger, protecting train movements, but the stand can only be padlocked when switch is in final main line position and distant signals are cleared. The Unity stand is simple in construction and is designed to operate either a wire-connected or electrically controlled distant signal. The facing point becomes operative with point ⅛ in. open, as shown by many tests, and in this position distant signal cannot be cleared.

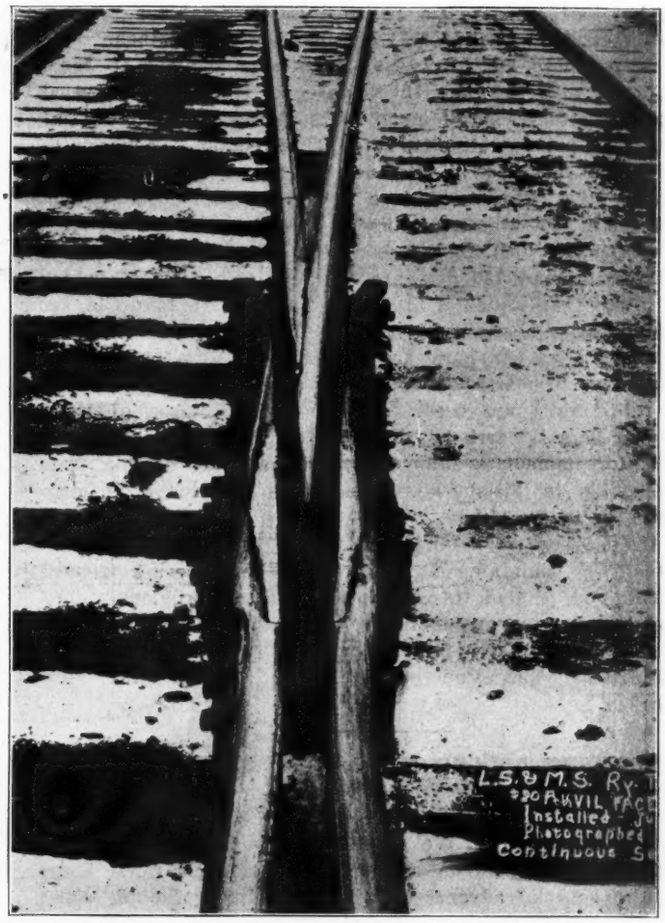
The following tests made by the Morden company with railway officers indicate the necessity for some form of facing point lock and further protection at facing point switches, than is given by ordinary switch stands.

Twelve switches were selected, all on main line, on well ballasted track, with heavy rail. Switch stands were of various makes; most of them the common form of high open main line stand, three being stands made by the Morden company. Small cut pieces of steel varying in width by eighths of an inch were used. These were inserted between the switch point and head of the stock rail over the head rod. A small man, weighing not more than 125 lbs., handled the switch stands and threw the switch. In ten of the switches ½-in. pieces of steel were inserted; in one a ¾-in. piece, and in one a 1-in. piece, and in all cases the switch stand was thrown with ease and padlocked, with target indicating "clear" with the obstruction as noted, and switch point dangerously foul, the actual point being open a slightly greater distance than the width of the test pieces of steel, as these were placed about 12 in. back of the point.

From watching and measuring the actual movement of stock rail and switch point, it was decided that the lost motion was about equally divided, the stock rail crowding over just about as much as the switch point bent back, and the full movement being evidently easily distributed through the various connections to the stand and in the stand itself.

NO. 20 ANVIL FACE FROG.

The frog shown in the accompanying illustration is a No. 20 anvil face frog, made by the Pennsylvania Steel Co., Steelton, Pa. It has been in service for 10 years and six months, having been placed in track on the Lake Shore & Michigan Southern at Air Line Junction, Toledo, Ohio, in July, 1899. It is estimated that this frog has outworn about seven ordinary ones. The one shown is of



the earlier design hard center frog, which has, of recent years, been improved by making the point, as well as the side blocks, of Manard, improved manganese steel. This improved type of frog has now come into universal use on most main lines and yards at points of heavy traffic.

HAVEMEYER BAR FOR REINFORCING CONCRETE.

The Havemeyer bar for reinforcing concrete is one which should appeal to all railway engineers and contractors who are desirous of securing high efficiency. The bar has a uniform cross section, the four projections and the lugs on the sides of the bar offsetting the amount of metal taken from the two corners of the bar. It is rolled to the same weight as a plain square bar, and can be readily substituted therefor, as the bar is a square bar

deformed, the full square section being shown between the projections.

The change of section from the plain square to the deformed section is gradual, and by this means the bar is not weakened at any point, and the full strength of the metal is developed. The section of the bar can be readily gauged or measured in actual practice by simply measuring the square section between the projections. This is a very important point, as it avoids confusion and possible error, which might be disastrous.

Laboratory tests have shown that this bar has the strongest possible grip when imbedded in concrete. Five samples were tested at the Stevens Institute, using a ¾-in. bar imbedded in a block of concrete 10 x 10 x 20 in. In each case the bar broke outside of the block of concrete and showed no slip, the average ultimate strength of the steel being 88,460 lbs. per square inch. Similar tests made with other types of deformed bars showed that the bars pulled through the concrete at considerable lower stresses. Five samples of ¾-in. twisted bars subjected to the same test pulled through the blocks of concrete on an average of 71,730 lbs. per square inch.

These bars are very easy for the contractor to fabricate or wire together, the square section forming a seat for the attachment of members, such as stirrups, etc., and the lugs prevent slipping in either direction. They can be readily bent cold in any desired angle, and tests have shown that they bend true and accurate, a quality not possessed by others, particularly with the twisted bar. Tests made with high carbon steel have shown that these bars will bend 180 deg. around their own diameter, which is more than a bar is ordinarily called upon to do in actual practice.

All Havemeyer bars are rolled from new billet steel, either open hearth or Bessemer, as may be desired. No re-rolled rails are used. A stock of all sizes of Havemeyer bars is carried in New York City and in Pittsburgh, Pa., for immediate shipment, mill shipments coming from the mills in Pittsburgh. These bars are rolled in sizes from ¼ in. to 1¼ in.

In addition to selling Havemeyer bars, the Concrete-Steel Co. maintains an experienced engineering department, and is glad to take up any difficult problems called for in concrete engineering.

A catalogue and full information can be obtained by addressing The Concrete-Steel Co., 29 Broadway, New York.

RAMAPO ROLLED MANGANESE STEEL SWITCH POINTS.

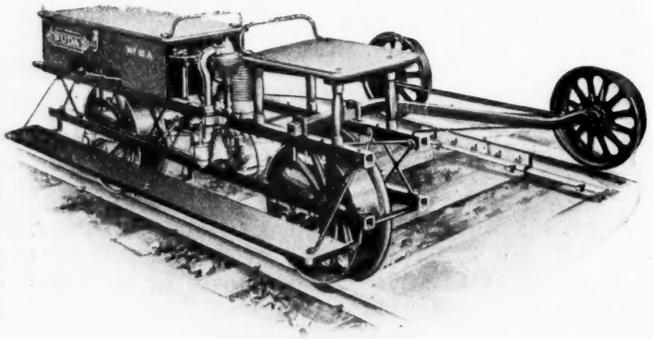
The Ramapo Iron Works, Hillburn, N. Y., is now offering switch points made of rolled manganese steel rail. These are of especial advantage for short radius turnouts, where curved switch points are used, particularly where the stock rail can be given a slight offset to allow a substantial point on the switch rail.

For straight featheredge switch points, where the point end is subjected to the severe wear, the Ramapo people advocate their style No. 12, where the switch rail, although continuous throughout its entire length, is equipped with a manganese point securely held in position. The manganese points of either construction, however, are said to be showing very remarkable service as compared with that of other steels. There are many busy railway yards now equipped with manganese points, especially on the high or turnout side of switches. For sharp radius turnouts, the switch points are frequently made double, providing a manganese guard which may be extended continuously from the switch point for the inside curved rail. The latter construction, however, is more applicable to city subways or elevated lines having a great many sharp curves.

Manganese pointed switches, or switches made entirely of manganese, from the present outlook will soon be in use at all busy points, not only due to their economy resulting from their long life, but also on account of the increased safety afforded.

BUDA NO. 12A MOTOR CAR.

One of the new motor cars being shown by the Buda Co. is its No. 12A. It is a four-wheel car accommodating three passengers. It has a 4 h.-p. air cooled engine of the four-cycle type driving through a compensating sprocket to the front wheel. The sills and guide arms of the car are of square steel tubing and the wheels are pressed steel.



Motor Velocipede.

This car is intended for heavy service on construction and repair work. It is capable of a speed of thirty miles an hour under full load and will negotiate any grade.

The tool box forms the back seat and contains the spark-coil, duplicate batteries, and a compartment for tools. The operator sits in the center of the car and both rear and operator's seats are well forward of the rear axle.

McDONALD REINFORCED CONCRETE CROSS TIE.

In June, 1907, the Atchison, Topeka & Santa Fe placed twenty McDonald reinforced concrete ties in the main track between Los Angeles, Cal., and Redonda Junction. In March, 1908, the inspector of track and roadway reported that the ties showed "no indication of deterioration or failure in any way," and in January, 1910, they were reported to be "in first-class condition in every respect." The track on this line is ballasted with gravel and the traffic is heavy.

The McDonald tie is reinforced with horizontal steel rods bent up under the rail seats and tied together at intervals with vertical rods, which serve also as web reinforcement. The rail is secured to the tie by spiking into sections of wrought iron pipe set in the concrete. The inside diameter of the pipe used for this purpose is a little less than the greatest dimension of the spike, in order that the spike may cut the metal enough to insure a firm connection. The length of the section of pipe is made the same as the depth of the tie, and both ends are passed through tie plates and expanded, so as to hold the plates solidly in the surface of the concrete. This construction allows the tie to be used with either face up. It is necessary to use a spike with a head so formed that its under face will conform to the top of the rail base when the spike is partially rotated, for at each re-driving the spike should be turned so that its edges will cut an unused portion of the pipe and furnish a new bond. When the surface of the concrete crumbles under the tie plate or the end of the tube becomes too badly worn to hold the spike, the tie may be turned over in the

track, thus providing a new surface and an unused portion of pipe to spike into.

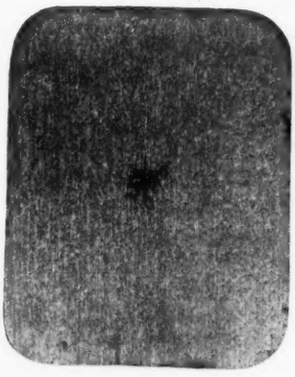
The cost of the tie when made in small numbers is given by the inventor as about $1.30, and it is stated on the same authority that a railway by using company forces in the making of the ties could reduce this price by at least 25 cents.

In addition to the installation on the Santa Fe, a slightly modified form of this tie has been installed on all the lines of the Los Angeles Railway company, but no reports of its performance in this service are as yet available.

The McDonald reinforced concrete tie is placed on the market by the McDonald Company, 617 Lissner building, Los Angeles, Cal.

INGOT IRON.

There are two items in the exhibit of the American Rolling Mill Company that show very markedly the differences between the ordinary steel product and the ingot iron, for which such decided non-corrosive qualities are claimed. The first does not particularly demonstrate this quality, but is intended to show the difference in the appearance of a section of ingot iron of steel and one of ingot iron. In the case of the iron the surface is smooth, homogeneous and free from blowholes, while that of the steel and from



Section from an Ingot of "Ingot Iron."

Section from an Ingot of Steel.

the same location in the ingot, is mostly holes and is far from being all that could be desired.

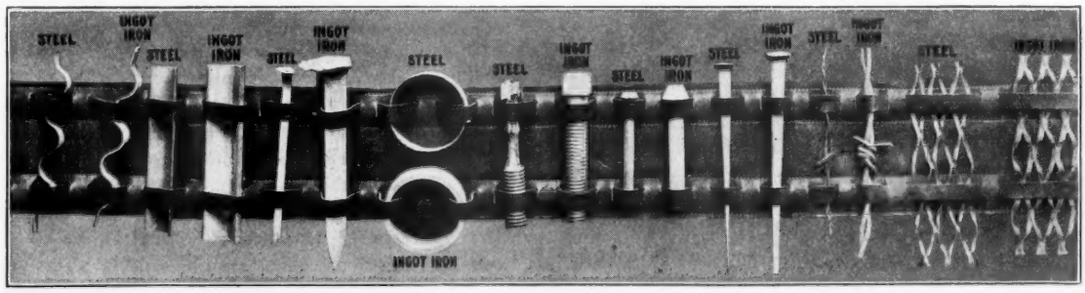
The other exhibit is certainly a most remarkable demonstration of the soundness of the electrolytic theory of corrosion. It consists of a series of articles, shown in pairs, that were originally identical in shape and size. One of each pair is of steel and the other of ingot iron, and each was subjected to the same corrosive action of an acid. The difference in the appearance of the two pieces is very marked, and that the steel was of a very uniform grade is shown by the maintainance of the shape in a reduced form. Take, for example, the spike. That made of ingot iron is up to nearly its original size, while that made of steel is reduced to lilliputian dimensions, and yet the head and shank remain clearly and unmistakably defined. The same holds, though perhaps not so strikingly, in each of the other pairs. It certainly does look from this as though a pure iron possessed the qualities of resistance to a corrosion to a high degree.

Q. & C. PORTABLE RAIL SAW.

A very effective track tool is found in the Q. & C. portable rail saw, shown in the accompanying illustration. The saw is made in two designs of two sizes each. One is designed for making right angle cuts, while the other is for cutting at an angle, in multiples of 5 degrees each, up to 45 degrees. The small size will cut all T-rails up to and including 100-pound sections, while the larger will cut a 9-in. girder rail of any regular section. The saw is anchored to the rail by an adjustable clamp jaw at the base, which is tightened by a screw and lever.

Q. & C. Portable Rail Saw.

The reducing gear is arranged on the side which supports the saw blade, and a simple form of automatic feed lowers the saw at proper speed for cutting the head or base of the rail. The feed screw is driven by a friction nut, which can quickly be released to feed the saw by hand through the web of the rail or return the slide. These saws make clean, perfect cuts, beginning in the center of the head and making a true vertical cut, leaving the ends of the rail smooth and straight. This portable saw, made by the Q. & C. Co., New York, is on exhibition in spaces 119-120 at the Coliseum.

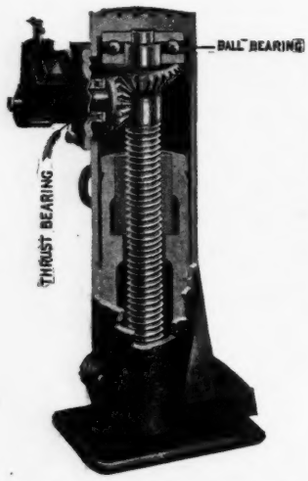


Example of the Difference in the Resistance to Corrosion of Ingot Iron and Steel.

JACKS.

The Duff-Bethlehem hydraulic jack, recently placed on the market by Fairbanks, Morse & Co., Chicago, is said to be so made that the objectionable features of the standard type of hydraulic jack are eliminated. One of the most frequent causes of trouble in the old type was leakage, which generally occurred at the joint between the base and outer cylinder. In the Duff-Bethlehem jacks the base and cylinder are a one-piece steel forging, which not only prevents leakage, but also eliminates the leather packing necessary in the old jacks. The ram is also a one-piece steel forging. The use of steel forgings makes a material reduction in weight of a jack of given capacity. For instance, a 40-ton Duff-Bethlehem broad base jack with a 12-in. raise weighs 141 lbs., while the same size in other makes weighs from 245 lbs. to 320 lbs.

Ball Bearing Geared Screw Jack.



Section of Ball Bearing Geared Screw Jacks.

Duff-Bethlehem Hydraulic Jack.

The same company also makes a ball-bearing jack in capacities up to 70 tons. The principal feature of advantage in the ball-bearing jack is that the bearing plates carrying the load are grooved so that the load instead of being carried at only two points on the balls' surface is distributed over a larger surface, reducing the liability of the balls breaking. Ball-thrust bearings are also provided for the operating lever.

The company still makes all types of the Barrett jacks for track and bridge work, car departments, etc. A new catalogue showing a large and complete line of jacks has just been issued by Fairbanks, Morse & Co., and they will send it on request.

SIGNAL LAMPS.

Perfect ventilation is claimed for the signal lamps which are exhibited by the Adams & Westlake Co., Chicago, in booths 83 and 84. The baffle-plates in the top of the lanterns are arranged to deflect the currents of air so as to produce the best possible results. The lamps have non-sweating top ventilation—which means no fogging of lenses, consequently the maximum of signaling efficiency. There is no flickering of flame, no overheating of lamp. Non-sweating insures long life of the body of the lamp, on account of the absence of corrosion from moisture. The lamps, which are made entirely of riveted Bessemer sheet steel, are of high quality, both in construction and finish.

ROCKFORD TRACK WEEDER.

The Rockford track weeder, which is on exhibition at the Coliseum in spaces No. 99 and 100, has attracted considerable attention from the visitors. This is the invention of "Jack" Duntley, as he is known to all railway men, who one year ago presented the Rockford gasoline motor car for section use. This weeder is on exhibition for the first time, although service tests were made last summer.

In order to arrive at the average cost of weeding track from the end of ties to grass line, reports were obtained by the Duntley Manufacturing Co., from 10 road masters. These reports show that it requires 6 6/10 laborers to clean one mile of track in one day, and with wages at $1.50 per day this work would cost $9.90. When this work is performed by hand it is necessary to weed the track about three times per year, which would make the weeding process cost $29.70 per mile each year.

The Rockford track weeder, according to the makers, will clean 20 miles of track in one day, at a cost of 60 cts. per mile, as follows:

1 man at $3.00	$ 3.00
4 men at $1.50	6.00
Gasoline	2.50
Lubricating oil	.50
	$12.00

Or 60 cts. per mile.

The machine removes weeds by the roots, and only two cleanings per year are necessary, making the cost of cleaning each year $1.20 per mile, as opposed to $29.70 by the old method. This shows a saving of 95 per cent., on which basis the machine will pay for itself in one week.

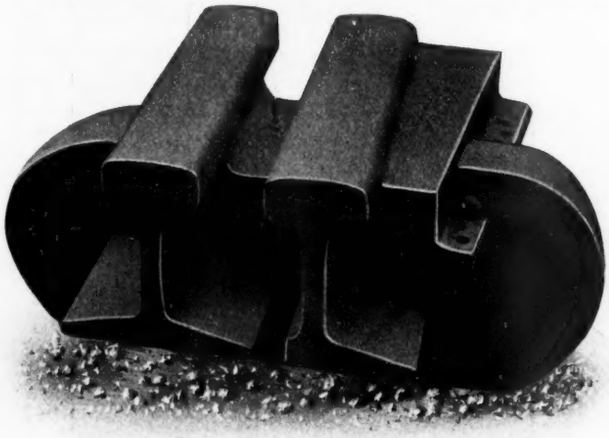
The machine is very similar to a harrow or cultivator, and is rigged to a Rockford gasoline locomotive No. 6. There are two upright posts with crank and chain attachment for lowering and raising arms to which are attached the teeth of the harrow, and at the outer end of these arms are idler wheels which ride the grass line and keep the harrows at the proper elevation to perform the most efficient service. It is simple and is well constructed, having practically no breaking parts. For railways which do not desire the weeder attached to a gasoline locomotive, it

can be furnished for use with a team of horses or a light steam locomotive.

The company advises that several orders for May and June delivery have already been received.

ADJUSTABLE GUARD RAIL CLAMPS.

Among the exhibits of the Morden Frog & Crossing Company, Chicago, in booth 86 at the Coliseum, are two styles of adjustable guard rail clamps. These clamps are forged



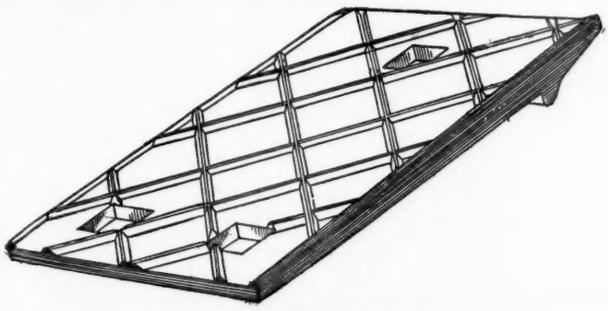
Adjustable Guard Rail Clamps.

from a single piece of heavy wrought iron, the central or saw-tooth block which gives the adjustment being of grey iron and the wedge of malleable iron. These clamps will permit a wear of ¾ in. on the guard rail and still maintain the normal throat of 1¾ in. by means of the adjustment.

SELLERS ANCHOR BOTTOM TIE PLATE.

The Sellers anchor bottom tie plate, made by the Sellers Manufacturing Company, Chicago, is designed to furnish perfect protection to the tie against cutting and consequent rotting; to provide the greatest resistance against track widening; to resist the effect of corrosion and brine drippings from refrigerator cars; to furnish protection to the spike and prevent spike necking, and to be easy of application or readjustment for track alinement on either hard or soft wood ties.

The corrugations on the bottom of the Sellers tie plate compress and engage the top fibers of the tie without cut-



Sellers Anchor Bottom Tie Plate.

ting. As these corrugations run across the fibers of the tie, they present as great as possible a surface to resist track spreading.

All of the Sellers plates are made with shoulders. Without shoulders, the provision against track spreading is only as great as the shearing strength of the outside spike.

These plates are rolled from wrought iron, it being claimed that an iron plate will wear better, under a steel rail, than will a steel plate.

BAUSCH & LOMB OPTICS.

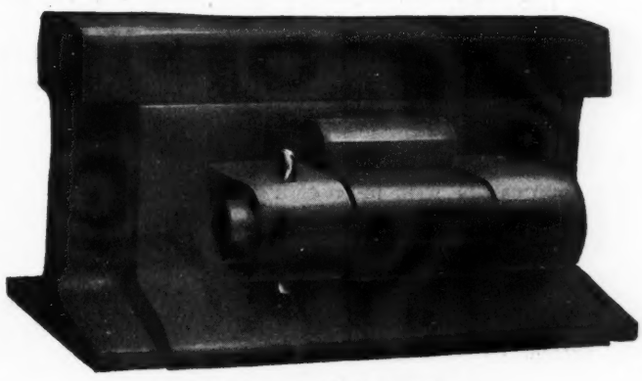
The Bausch & Lomb Optical Company, Rochester, N. Y., announces that during the present year it will present an entirely new system of optics, combined with an improved mechanical equipment.

There are three principal sources of error in using a precision instrument; natural, personal and instrumental. To be able to secure a transit, whose circles are divided upon automatic engines, and to know that such an instrument was equipped with lenses of the finest optical glass, ground to approved formulæ, is a consideration of prime importance. The engineer is fully aware of the fact that, while he may improve his methods of handling a precision instrument, a cheaply built one is always a defective piece of mechanism.

WOLFE AUTOMATIC LOCK.

The U. S. Metal & Manufacturing Co., New York, has on exhibition, in space 18, the Wolfe automatic rail joint lock, which has attracted wide attention within the past seven months, and is said to have been applied by the principal steam and electric railways in the country and adopted by many of them as the standard fitting for joints and crossings.

This lock is designed to keep angle bars at a joint or crossing absolutely tight and to insure a perfectly level rail. As previously described in the Railway Age Gazette,



Wolfe Automatic Lock.

the purpose of the Wolfe automatic joint lock is to take up the slack due to elongation of the track bolts and wear of angle bars at the joint.

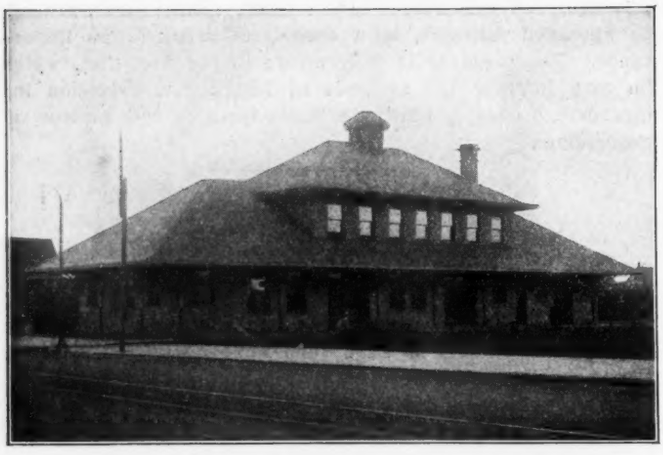
So-called patented rail joints and nut locks have been used in an effort to overcome the difficulty of loose rail joints. The device here shown consists of an elongated nut screwed on the ordinary track bolt. A bolt passes through the holes in adjoining nuts and is held in place by a cotter pin. Between the nuts is a malleable cam-shaped piece, through which the bolt passes. This, when turned in a horizontal position, allows a small space between it and the fish plate, and into this an iron wedge is inserted. The cam-shaped piece turns on the bolt and cannot rise, but must fall, taking the wedge with it, thus taking up any slack.

The device is applied to the joint bolt in pairs. When applied to the center bolts, the nuts on the others are kept tight, so that it is not necessary, save under severe conditions, to apply it to more than one pair of bolts.

It is said that this lock will prevent loose bolts and joints, wearing of the angle bar and battering and corrosion of the threads and bolts. Also, that it will eliminate the work of the track walker in tightening nuts and materially help in keeping the track properly bonded.

SHEATHING LINOFELT.

The Mineral Range passenger station at Calumet, Mich., shown in the accompanying cut, is lined with sheathing linofelt, a product which, on account of its insulating qualities, is well adapted to buildings in a cold climate. The linofelt used in building construction differs from the refrigerating linofelt, being only ¼-in. thick and covered with a lighter grade of paper which is not waterproof, as it is in the heavier material. This makes the cost of the



Mineral Range Station at Calumet, Mich.

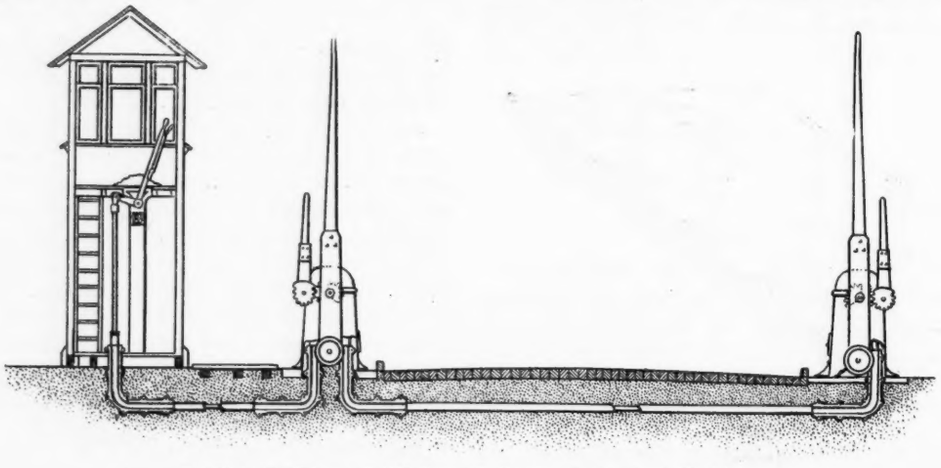
sheathing material less without reducing the effectiveness of the insulation. One or two thicknesses are applied, depending on local conditions.

For shops or any buildings with a concrete roof, in which condensation of water is troublesome, the heavier grade of linofelt is used, and its waterproofing qualities eliminate the trouble.

This material is made by the Union Fibre Co., Winona, Minn., and can be seen in booth 171 at the Coliseum.

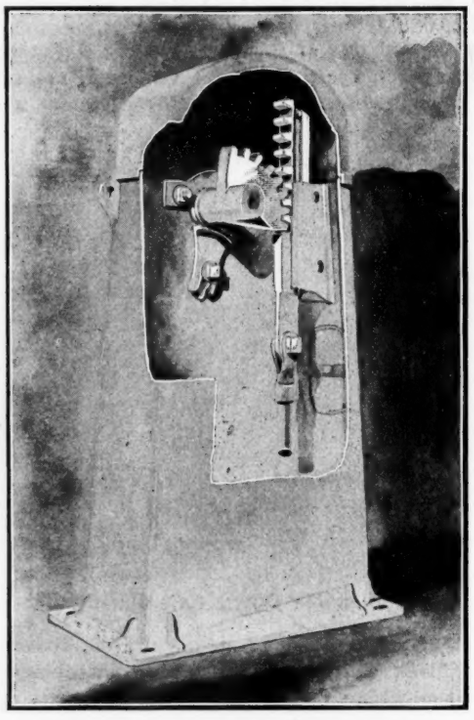
WILSON RAILWAY GATE.

The protection afforded by crossing gates should be well considered by maintenance of way officers. The flagman can protect but one side of the crossing at a time, while the gates protect both sides.



Sectional View of Wilson Railway Gate Installation.

In a perfect working crossing gate, four main points are essential: strength, reliability, direct positive action and economy of maintenance. The Wilson gate is simple in design, there being no complicated mechanisms to get out of order, and to require frequent adjustment. All parts of the Wilson gate are designed to withstand a greater strain than any to which they will be subjected in service. No wood is used in the installation, excepting for the street arms, all material being iron, steel and cement. Provision is also made to prevent freezing. The post is made of



Cast Iron Post for Wilson Railway Gate.

cast iron and all working parts are protected from the elements.

The operating levers provide for locking the gates in either direction. It is frequently necessary to check the arms quickly after they have been put in motion, and the Wilson gate is under complete control of the operator at all times. The direct rigid connections provide for this absolute control.

All turns are made in watertight deflecting boxes, by the use of anti-friction rollers. These deflecting boxes are made in acute, obtuse or right angles. After the connections have been made, the two-inch pipe line from the lever stand to the gate post is filled with cold test oil.

The Wilson railway crossing gate has been added to the specialties of the Kalamazoo Railway Supply Co., Kalamazoo, Mich., and is exhibited in space 25 at the Coliseum.